Scheme of Teaching and Examination for

3rd Semester of 3 Years Diploma in Auto Mobile Engineering

Duration of Semester : **14 Weeks**
Student Contact Hours : **36 Hrs**
Total Marks : **800**
Effective from : 2017 -18 Session

Sl. No.	Name of Subject	Subject Code	Subject	Teaching Scheme			Examination Scheme					
				L	T	P	Hours of Exam	Full Marks of Subject	Final Exam / committee marks	Internal Assessment	Pass Marks Final / Ext. Exam	Pass Marks in Subjects
1.	Engineering Math – III	301	Theory	3		-	3	100	80	20	26	40
2.	Automobile Engines	AUT303	Theory	3	-	-	3	100	80	20	26	40
3.	Engineering Materials	MEC304	Theory	3	-	-	3	100	80	20	26	40
4.	Engineering Mechanics	MEC305	Theory	3	-	-	3	100	80	20	26	40
5.	Strength of Materials	MEC306	Theory	3	-	-	3	100	80	20	26	40
6.	Automobile Engines- Lab	AUT304	Practical	-	-	4	4	100	80	20		40
7.	Engineering Mechanics Lab	MEC308	Practical	-	-	2	4	50	40	10		20
8.	Strength of Materials Lab	MEC309	Practical	-	-	4	4	100	80	20	-	40
9.	DLS	302	Sessional	-	-	4		50	30	20	-	25
Total Hours of Teaching per week :				**15**		**14**						

Total Marks : Theory : Practical : Sessional :
L : Lecture, T : Tutorial P : Practical

Note:
1. Period of Class hours should be of 1 hrs duration as per AICTE norms.
2. Remaining Hrs every week has been marked for students for Library and Student Centered Activities.
3. Drawing / Graphics / Practical / Sessional examinations will be held at parent institution.
4. Board will depute examiner for Practical examination.
5. Regarding sessional examination the parent institution will form a three member committee and this committee will examine the sessional records and hold viva of the examinee for 60 % marks allotted to the subject. Marks for remaining 40 % will be provided by the Faculty concerned on the basis of evaluation of each job / work throughout the semester.

CourseName: 03 Years DiplomainEngineering (All branch except Mining , Arch & Non Tech)

Semester : Third

SubjectTitle : Engineering Mathematics-3

SubjectCode: 301

TeachingandExamination Scheme:

Teaching Scheme			ExaminationScheme					
L TH	T	P	Full Marks.	External Exam Marks	Internal Exam Marks	External Pas Marks	Total Pass Marks	Duration of External Exams
03	01		100	80	20	26	40	3 Hrs

NOTE:Internal marks will be allotted on the basis of two snap tests and 2 assignment of equal marks to be conducted by the faculty teaching the subject.

Rationale:

The subject is extension of Engineering Mathematics – 1 & 2 of First year and stepping into the prerequisites to learn Applied Mathematics applicable in engineering solutions. Engineering Mathematics lay down the foundation to understand and express principles and laws involved in other technological subjects. The study of Engineering Mathematics will help to develop the skills essential for new emerging avenues.

Objective:

The student will be able to acquire knowledge of mathematical terms, concepts and principles. They can acquire sufficient mathematical techniques and can develop the ability to apply mathematical methods to solve technical and day to day practical problems and to execute management plans with precision.

Sub Objective:

This course is divided into five units. After completion of this course one could become able to learn the following.

- Intuitive meaning and Methods of finding integration definite integration and its properties.
- Application of Integration in finding Area, volume of irregular shapes.
- Methods of solving differential equation of first order and first degree.
- Methods for finding approximate roots by using bisection, Regula-falsi,Newton-Raphsonmethod, Gauss elimination,Jacobi and Gauss- Seidal methods.
- Use of Binomial, Normal and Poissondistributions for solvingdifferent examples.

- UseofLaplace transformfor solving problemsof Differential Equations.
- Useof Fourier seriesfor expansion offunction atthegiven intervals

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	**Integration:** 1.1 Definition of integration as anti-derivative. Integration of standard function. 1.2 Rules of integration (Integrals of sum, difference, scalar multiplication). 1.3 Methods of Integration. 1.3.1 Integration by trigonometrical transformation. 1.3.2 Integration by substitution 1.3.3 Integration by parts. 1.3.4 Integration of rational and irrational functions. 1.3.5 Integration by Partial fractions.	6	16
	1.4Definite Integration. 1.4.1 Concept of definite integrations with examples. 1.4.2 Properties of definite integral with simple problems.	3	
	1.5 **Applications of definite integrals.** 1.5.1 Area under the curve. 1.5.2 Area bounded by two curves.	3	
2	**Differential Equation** 2.1 Definition of differential equation, order and degree of differential equation. Formation of differential equation. 2.2 Solution of differential equations of first order and first Degree such as variable separable form, reducible to Variable separable, Homogeneous and Linear Differential Equation.	6	16
	2.3 **Applications of Differential equations.** 2.3.1 Rectilinear motion (motion under constant and variable acceleration) 2.3.2 Newton's Law of Cooling	2	
3	**Numerical Methods** **3.1 Solution of algebraic equations** Bisection method, Regula falsi method and Newton–Raphson method.	3	16
	3.2 Solution of simultaneous equations containing 3 unknowns		

	3.2.1 Gauss elimination method. 3.2.2 Jacobi's Iterative method. 3.3.3 Gauss Seidal method.	3	
	3.3 Interpolation 3.3.1 Concept of interpolation and extrapolation. 3.3.2 Different operators $(\Delta, \nabla \& E)$,relation between them, some problems based on operators , formation of Difference Table. 3.3.3 Newton's Forward and Backward difference interpolation formulae. 3.3.4 Lagrange's interpolation formula. 3.3.5 Problems based on above.	4	
	3.4 Numerical Differentiation &Integration. 3.4.1 Newton's forward and backward difference formulae for first and second order differentiation at any point. 3.4.2 Numerical integration Trapezoidal rule and Simpson's 1/3rd rule.	3	
4	**4.1 Probability:** 4.1.1 Definition of random experiment, sample space, event occurrence of event and types of events (impossible, mutually exclusive, exhaustive, equally likely) 4.1.2 Definition of probability, addition and multiplication theorems of probability.	04	16
	4.2 Probability Distribution 4.2.1 Binomial distribution. 4.2.2 Poisson's distribution. 4.2.3 Normal distribution 4.2.4 Simple examples based on above .	04	
5	**Laplace Transform** 5.1 Definition of Laplace transform, Laplace transform of standard functions. 5.2 Properties of Laplace transform such as Linearity, first shifting, second shifting, multiplication by t^n, division by t. 5.3 Inverse Laplace transforms. Properties-linearly first shifting, second shifting. Method of partial fractions,	3	16
6	**Fourier Series** 6.1 Definition of Fourier series (Euler'sformula). 6.2 Series expansion of continuous functions in the intervals $(0,2l),(-l,l),(0,2\pi),(-\pi,\pi)$	3	
7	**Linear Programming** **7.1 Introduction** **7.2 Solution of Linear Programming problem (LPP) by Graphical Method.**	3	

	TOTAL:	50	80

Tutorial: Tutorials are to be used to get enough practice for solving problems. It is suggested that in each tutorial at least five problems should be solved.

Learning Resources:

Books:

Sr. No	Title	Authors	Publications
1	Engineering Mathematics	H.K.Das	S.Chand & Company LTD, New Delhi
2	Higher Engineering Mathematics	B.V,Ramana	Mcgraw Hill Education (India) Private limited , New Delhi
3	Senior Secondary School Mathematics for Class 12	R.S.Aggarwal	Bharati Bhavan , Patna
4	JMD Dinesh Companion Mathematics for Class 12	O.P. Arora & V.K.Bhadani	S,Dinesh & Company
5	A text book for class 12, Part- I & II	NCERT	NCERT, Delhi
6	Ordinary Partial Differential Equation	M.D.RaiSinghania	S Chand & Company LTD, New Delhi
7	Applied Mathematics- Semester- III	Jhunjhunwala	Vidyadhar Nager, Jaipur

Note:

In board examination, question setter may be advised to select 20% questions of objective, 30% of short type and remaining 50% of long type based on basic concepts, formula and calculations respectively.

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Automobile Engines

Diploma in Automobile Engg
III Semester
Subject – Automobile Engines (3rdSem)

L	T	P	Total Hours 42 Th
3		4	FM 100 Th 50 Pr

1. Introduction — Hrs. 06

1.1 Components of automobile, Engine systems, Basic engine terminology, Engine Cycles (Otto and Diesel), working of I.C engines, Firing order.

1.2 Effect of Engine size, effect of flywheel size, use of multi-cylinder engines, comparison of single and multi-cylinder engines.

1.3 Types of engines, Number and arrangement of cylinders, square engine, and Homogenous charge compression ignition engine.

1.4 Electric vehicle, Hybrid vehicle, wheel motors, fuel cell vehicle, RAC rating, SAE rating, DIN rating.

2. Engine Construction — Hrs. 06

2.1 Introduction, Cylinder Block and Crankcase, Cylinder Head, Oil Pan, Manifolds, Gaskets, connecting Rod, Piston Pin, Crankshafts, Vibration Dampers, Engine Bearings

2.2 Valve Timings, Maximum valve openings, Engine valve, Poppet valve, valve actuating mechanism, factors for Valve train components, details valve rotators.

2.3 Variable Valve Timing (VVT) Technologies, V-TEC technology, Fiat Multi air technology, Borg warner's VEMB, Cam-less engine, Mufflers, Latest trends.

3. Cooling Systems — Hrs. 04

3.1 Necessity, Methods of cooling, Air Cooling, Water Cooling

3.2 Components of water cooling system, Radiator, Pressure cap and expansion reservoir.

3.3 Thermostat, coolant pump, fan, coolants, and temperature gauges.

4. Lubricating Systems **Hrs. 05**

4.1 Introduction, Necessity of lubrication, Requirements of lubricants, types of lubricants

4.2 Viscosity rating, service rating, testing of lubricants, oil additives, systems of engine lubrication.

4.3 Oil strainers, Oil pumps, Oil filters, Oil Coolers. Oil level Indicators, Oil Pressure gauges, Oil Pressure warning light, chassis lubrication.

5. Fuels, Combustion & Combustion Chambers
Hrs. 05

5.1 Properties of conventional fuels i.e petrol and diesel, alternative fuels-alcohols, CNG, LPG, Bio-Diesel, Hydrogen.

5.2 Combustion in SI engines, Detonation in SI engines, Theories of detonation, Factors influencing detonation, Effects of detonation, prevention of detonation, fuel rating, Octane Number, Pre-ignition, Terms relating to rate of combustion, factors affecting combustion chamber design, desirable factors for combustion chambers in SI engines.

5.3 Combustion in CI engine, Diesel Knock, Cetane Number, Diesel Index, Comparison between detonation and diesel knock, combustion chambers for CI engines.

6. Petrol engine fuel supply system
Hrs. 06

6.1 Fuel supply systems, fuel tank, vapour return line, air cleaners, Fuel filters, fuel gauge, brief introduction to carburettor.

6.2 Petrol injection- Introduction, comparison with carburettor, types, mechanical injection, electronic injection, main components of petrol injection systems.

6.3 Bosch motronic Gasoline system, DI motronic system, natural Gas motronic.

6.4 Super chargers, types of superchargers, Turbo charger, Comparison of super charged and Turbocharged engines.

7. Diesel engine fuel supply system

Hrs. 06

7.1 Introduction, common rail fuel injection system, Individual Pump fuel injection system, fuel filters, Air cleaners, Fuel feed pump, fuel injection pump, Fuel Injector, Governor.

7.2 Modern common Rail fuel injection system, Engine management in Common Rail System(CRS), Bosch third generation CRS, Volvo's i-ART technology, Unit Injection system, Unit Pump System.

8. Emission Control

Hrs. 04

8.1 Introduction, Euro Norms, Bharat Stage Norms, Methods of reducing the formation of pollutants, closed crank case ventilation, reducing evaporative emission, Exhaust gas recirculation, Catalytic convertors, Exhaust treatment for diesel engines.

8.2 Adsorbers, Use of alternative fuel.

LearningResources:

Books:

Sr. No.	Author	Title	Publisher
01	KirpalSingh	AutomobileEngineering Vol.II	StandardPublication
02	AnthonySchwaller	Motorautomotivetechnology	DelmarPublisherInc.
03	TimGills	Automotiveservice	DelmarPublisherInc.
04	AnilChikkara	AutomobileEngineering Vol.I	SatyaPrakashanNewDelhi
05	Crouse/Anglin.	AutomobileMechanics	TATAMcGraw–HILL
06	HarbansSingthRoyat	TheAutomobile	S.ChandPublication
07	R.B.Gupta	AutomobileEngineering	SatyaPrakashanNewDelhi
08	S.Srinivisan	AutomotiveMechanics	TATAMcGraw–HILL
09	HMSETHI	AutomotiveTechnology	TATAMcGraw–HILL

List of experiments

1. Demonstration of engine components and describe the working, function, Location and materials used for each component and method of disassembling and Assembling.
2. Demonstration of cooling system components and describe the working, function location and materials used for each component and method of disassembling and Assembling.
3. Demonstration of diesel engine fuel supply systems i.e, common Rail fuel supply system and individual pump fuel supply system and method of disassembling and Assembling.
4. Demonstration of multi point fuel injection system used in petrol engines.
5. Set the valve timing for both inlet and exhaust valve on a multi cylinder engine.
6. To find the Indicated Power (IP) on multi-cylinder petrol engine by Morse test.
7. Determination of the performance and heat balance characteristics of a diesel engine.
8. To diagnose Electronic Fuel Injection (EFI) with Diagnostic Read out Tester/engine Scanner.
9. Measure the emission of C.I engine using Smoke Meter and compare it with the emission norms.
10. Measure the emission of S.I engine using exhaust gas analysers and compare it with the emission norms.

Engineering Materials

L T P **Total Theory Hrs 42**
3 **FM 100Th**

1.Engineering Materials and Their Properties **6**

1.1 Introduction, Classification and Application of Engineering materials, I.S specification of materials like plain carbon steel, Grey Cast iron, low alloy steels & bearing Materials.

1.2 Properties of metals:-Strength, elasticity, ductility, malleability, plasticity, toughness, hardness, harden ability, brittleness, fatigue, thermal conductivity, electrical conductivity, thermal coefficient of linear expansion.

1.3 Imperfection in Crystals:- Basic concept of crystal, crystal pattern of unit cells, ideal crystal and crystal imperfection. classify crystal imperfections or defects such as point defects, line defects, surface defect and volume defects. State types of dislocation.

2.Ferrous Metals and Alloys 10(6+4)

2.1- Ferrous Metals

2.1.1 Characteristics and application of ferrous metals , Flow diagram for production of Iron and Steel, Classification, composition and uses of cast iron, effect of alloying elements like sulphur, silicon and phosphorous on cast iron.

2.1.2 Classification, composition and application of low carbon steel, medium carbon steel and high carbon steel with their chemical composition.

2.1.3 Magnetic materials: - Properties & Applications of commonly used magnetic materials (Permanent magnets and temporary magnets).

2.1.4 Fe-C Phase Equilibrium Diagram – Critical temperature lines , study of micro constituents of iron and steel.

2.1.5 Introduction of TTT curves.

2.2:- Alloy Steels

2.2.1 **Alloy Steels:** - Low alloy steel, high alloy steel, tools steel & stainless steel. Effect of various alloying elements such as – Chromium, nickel, manganese, molybdenum, tungsten, vanadium, etc.

2.2.2 **Tool Steels**: - High speed Steels (HSS), Hot & cold Working dies, shear, punches etc., properties & applications.

2.2.3 **Special Cutting Tool Materials** – Diamond, Stelites & Tungsten Carbide.

3.Non Ferrous Metals and Alloys **6**

3.1 Properties, applications & chemical compositions of Copper alloys (naval brass, muntz metal, Gun metal & bronzes), Aluminium alloys (Y-alloy & duralumin)

3.2 Various Lead and Zinc alloys. Alloys used for high temperature services.

3.3 Bearing materials like white metals, leaded bronzes & copper lead alloys and their desired properties.

4.Heat Treatment of Steels **8**

4.1 Basic concept of Heat treatment processes - Annealing, Normalizing, Hardening, Tempering.

Austempering & Martempering.

4.2 Basic concept of Surface Hardening Processes - Flame Hardening, Induction Hardening, Nitriding, Cyniding, Carburizing, Carbonitriding.

5.Non Metallic Materials 6

5.1 Polymeric Materials – Introduction to Polymers- types, characteristics, properties and uses.

5.2 Thermoplastic Plastics & Thermosetting Plastics - characteristics and uses of, Acrylics, Nylons polyesters, Epoxies, Melamines & Bakelites.

5.4 Rubbers – Neoprene, Butadiene, Buna & Silicons – Properties & applications.

5.5 Properties and applications of following Engineering Materials – Ceramics, Abrasive, Adhesive and Insulating materials such as Cork, Asbestos, Thermocole and Glass Wool

5.6 Introduction to Composite Materials – Laminated & Fibre, reinforced materials - Structure, Properties & Applications.

6. Destructive & Nondestructive Testing 6

6.1 Destructive Testing – Types, Concept and processes of Hardness & Toughness.

6.2 Importance of Non-destructive testing, Difference between Destructive and Nondestructive testing.

6.3 Nondestructive testing methods - Radiography (X-Ray & Gamma Ray), Ultrasonic crack detection, Dye penetrant test.

Books Recommended

1	A Text Book of Material Science & Metallurgy	OP Khanna
2	Material Science & Metallurgy	R K Rajput
3	Material Science & Metallurgy	V D Kodgire
4	Material Science	Callisper

Engineering Mechanics

L T P **Total Theory Hrs 42**
3 2 **F M: 100Th + 50Pr**

1.Introduction to Engineering Mechanics 2

Definitions of mechanics, Engineering Mechanics, statics, dynamics, kinematics, kinetics, particles, body, rigid body, mass, weight, length, time, scalar and vector, S.I. units.

2. Force 10

2.1 Force & Force system: - Definition of a force, S.I. unit of a force, representation of a force by vector and by Bow's notation method, classification of force system according to plane and line of action, Characteristics of a force, effects of a force, principle of transmissibility.

2.2 Resolution of a force: Definition, Method of resolution, Types of Component of a force - Perpendicular component and Non-perpendicular component.

2.3 Moment of a force: - Definition, measurement of moment of a force, SI Unit, geometrical meaning of moment of a force, classification of moments according to direction of rotation, sign convention, law of moments, Varignon's theorem of moment and its use.

2.4 Couple – Definition, S.I. unit, measurement of a couple, properties of couple.

2.5 Composition of Forces: - Definition, Resultant force, methods of composition of forces, Analytical methods: Trigonometric method (law of parallelogram of forces) and Algebraic method (method of resolution) for calculation of resultant for all force systems.

3. Equilibrium: 8

3.1 Conditions of equilibrium- analytical and graphical conditions of equilibrium for concurrent, parallel force system, non-concurrent non parallel force system, free body and free body diagram.

3.2 Lami's Theorem – Statement and explanation, Application of Lami's theorem for solving various engineering problems having two unknown only.

3.3 Equilibrant – Definition, relation between resultant and equilibrant, equilibrant of concurrent and non-concurrent force system.

3.4 Collision- Collision of elastic and inelastic bodies, coefficient of restitution, loss of kinetic energy during impact.(simple problem related with collision)

3.5 Truss - Introduction, Reaction at supports, Forces in a member by method of joints and method of section, Simple problems on methods of joints only).

4. Centroid and Centre Of Gravity: 6

4.1 Centroid: Definition of centroid & moment of an area about an axis, centroid of basic geometrical figures such as square, rectangle, triangle, circle, semicircle and quarter circle. Centroid of composite geometrical figures.

4.2 Centre of gravity: Definition, centre of gravity of simple solids such as cylinder, sphere, hemisphere, cone, cube, and rectangular block, centre of gravity of composite solids (Any types of hollow solids shall not be considered).

5.Friction: **8**

5.1 Definition and basic concept of -friction, force of friction, limiting frictional force, coefficient of friction, angle of friction, angle of repose, relation among angle of friction, angle of repose and coefficient of friction. Cone of friction, types of friction, laws of friction, advantages and disadvantages of friction.

5.2 Equilibrium of bodies on level plane – external force applied horizontal and inclined (Pull & Push)

5.3 Equilibrium of bodies on inclined plane – external forces is applied parallel to the plane.

5.4 Ladder Friction & Wedge Friction (simple numerical only).

6 .Simple Machines: **8**

6.1 Basic concept and definition of load, effort, mechanical advantage, velocity ratio and efficiency of a simple lifting machine, relation among mechanical advantage , velocity ratio and efficiency of a machine, Ideal machine, ideal effort and ideal load, friction in machines.

6.2 Law of machine, maximum mechanical advantage and maximum efficiency of a machine, reversibility of a machine, condition for reversibility of a machine (no derivation) and self-locking machine.

6.3 Basic concept of Lever & their types, Pulleys (fixed & movable), simple wheel and axle, winch crab, worm & worm wheel and screw jack (simple problems on lever only).

Recommended Books:

1. **Engineering Mechanics** **R K Bansal**
2. **Engineering Mechanics** **D S Kumar**
3. **Engineering Mechanics** **R S Khurmi**

Reference Books

1. **Vector Mechanics for Engineers: Statics & Dynamics** **Beer & Jhonson**
2. **Engineering Mechanics : Statics & Dynamics** **I A Shames**

List of Practical's:-

1) To verify law of polygon of forces.
2) To verify law of moments.
3) To verification of Lami's theorem.
4) To determine the forces in members of a jib crane.
5) Comparison of coefficient of friction of various pair of surfaces and determination of angle of repose.
6) To verify force transmitted by members of truss.
7) Experimental location of center of gravity of plane plate of uniform thickness.
8) Find MA, VR, Efficiency, Ideal Effort, Effort lost in friction for various loads and establish law of machine and calculate maximum efficiency. Also check the reversibility of the following.
    a) Worm and worm wheel or Differential axle and wheel
    b) Single purchase crab or Double purchase crab
    c) Simple screw jack.

Course Name : Mechanical Engineering

Semester : Third

Subject Title : Strength of Materials

Subject Code :

Teaching and Examination Scheme:

Teaching Scheme			**Examination Scheme**					
TH	TU	PR	PAPER HRS.	TH	Th Fin	Th Int	Pr	TOTAL
03	--	02	03	100	80	20	50	150

Rationale:

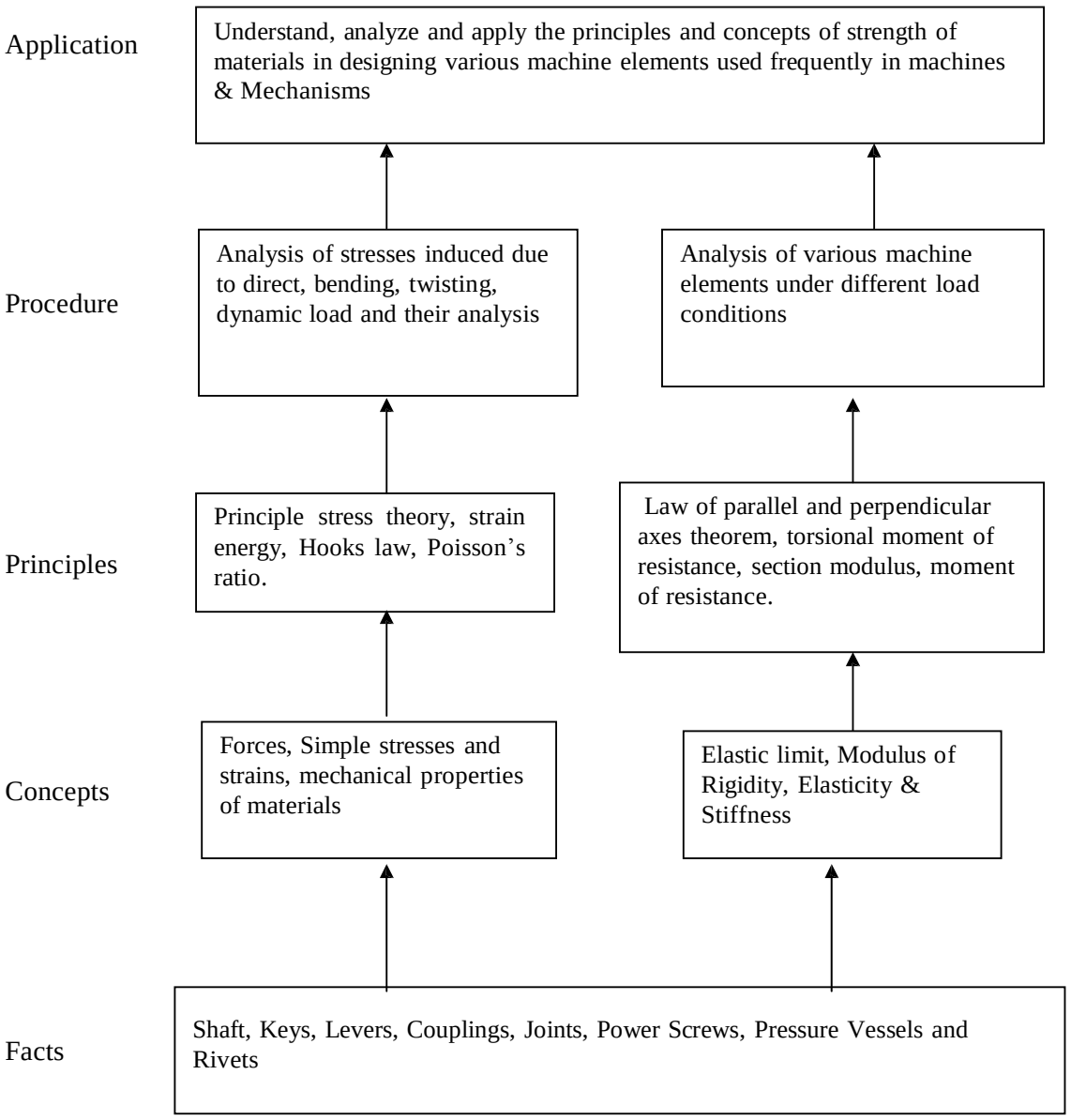
Strength of Material is a core technology subject. It aims at enabling the student to understand & analyze various types of loads, stresses & strains along with main causes of failure of machine parts. The subject is pre-requisite for understanding principles of machine design. Understanding mechanical properties of materials will help in selecting the suitable materials for various engineering applications.

Objectives:

The Student should be able to:

1. Understand the fundamentals of solid mechanics.
2. Acquire elementary knowledge of stresses, strains & material properties.
3. Understand & analyze the basic principles involved in the behavior of machine parts under load in the context of designing it.
4. Understand & analyze the mechanical properties of the various materials.

Learning Structure:



Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	**Mechanical Properties of Materials, Simple stresses & Strains** 1.1 Mechanical properties – Elasticity, Plasticity, Rigidity, Ductility, Malleability, Toughness, Hardness, Brittleness, Creep, Fatigue. 1.2 Concept & Definition of Simple stresses & strains Types - tensile, compressive, Shear, single & double shear, Punching shear, Hooke's law, Young's modulus, Modulus of Rigidity, Change in length of the bar having uniform & stepped cross section stress-strain curves for ductile & brittle materials. 1.3 Volumetric Strain, Bulk modulus, Poisson's ratio. Bi-Axial & Tri-axial stresses & strains. Relationship among E, G, & K. ***(No Derivation)*** 1.4 Stresses & strains in bars of uniformly varying section subjected to axial load at ends only, Composite sections having same length. 1.5 Temperature stresses & strains of uniform & ***composite*** sections. 1.6 Buckling of long columns 'Euler's theory, Rankine's theory – equivalent length of the column for the cases of Both ends hinged, One end fixed and other free, Both ends fixed, One end fixed and other end hinged. (simple numerical only)	8	
02	**Bending Moment & Shear Force** 2.1 Concept & definition of Shear force & bending moment. Relation between rate of loading, shear force & bending moment. 2.2 Shear force & bending moment diagrams for cantilevers, simply supported beam & over hanging beam subjected to point loads, Uniformly distributed load, Uniformly varying load. 2.3 Location of point of contra flexure. (Problem to be based on simply supported and cantilever beams with point load and UDL only)	06	
03	Principal stresses and planes. 3.1 Determine normal stress, shear stress and resultant stress on oblique plane 3.2 Define principal plane & principal stress 3.3 Determine principle plane, principal stresses analytically 3.4 Determine principal stress from Mohr's circle (only simple numericals). Thin Cylindrical shell -- 4 Marks • Stresses in thin closed cylindrical vessels subjected to internal pressure, Hoop stress, Radial & Axial Stress.(Simple numericals only)	06	

04	**Moment of Inertia** 4.1 Concept & definition of Moment of inertia, radius of gyration. Parallel & perpendicular axes theorem. (No derivation) 4.2 Moment of inertia of square, rectangular, circular, semicircular, Triangular, Hollow square, Rectangular & circular only. 4.3 MI of angle section, Channel section, Tee- section, I section about centroidal axis & any other axis parallel to centroidal axis. 4.4 Polar moment of inertia.	06	
05	**Bending *and Shear* stresses** 5.1 Theory of simple bending, Assumptions in the theory of bending, moment of resistance, section modulus & neutral axis. Stress distribution diagram for Cantilever & simply supported beam. 5.2 Equation of bending(No derivation) 5.3 Simple numeral problem. 5.4 Concept of direct & transverse shear stress. 5.5 Shear stress equation (No derivation) 5.6 Shear stress distribution diagrams Average shear stress & Maximum shear stress for rectangular & circular section.	06	
06	***Combination of Direct and Bending Stresses*** 6.1 Concept of Axial load, eccentric load, direct stresses, bending stresses, maximum & minimum stresses. 6.2 Stress distribution diagram. 6.3 Condition for no tension in the section. 6.4 Problems on the above concepts for machine parts such as offset links, C-clamp, Bench vice, Drilling machine frame etc. ***(Simple problems on the above applications)***	04	
07	**Torsion** 7.1 Concept of Pure Torsion, Assumptions in theory of pure Torsion, Torsion equation for solid and hollow circular shafts. ***(No derivation)*** 7.2 Power transmitted by a shaft. 7.3 Comparison between Solid and Hollow Shafts subjected to pure torsion (no problem on composite and non homogeneous shaft)	03	
08	***Deflection and Slope of Beam*** ***8.1 Concepts of Deflection & Slope of beams-relation between bending moment and slope. Deflection of simply supported beams and cantilever beams subjected to point load(No Derivation)***	03	
	Total	**42**	

Learning Resources:

Books:

SN	Author	Title	Publication
01	R K Rajput	Strength of Material	
02	B.K.Sarkar	Strength of Material	Tata McGraw hill New Delhi
03	Dr. R. K.Bansal	A Text Book strength of Material	Laxmi Publication New Delhi
04	S Ramamrutham	Strength of Material	Dhanpat Rai & Publication New Delhi
05	R.S.Khurmi	Strength of Material	S.Chand Company Ltd. Delhi
06	Andrew Pytel Fedrinand L. Singer	Strength of Material	Addison-Wesley An imprint of Addison Wesley Longman, Inc. Forth edition

List of Practical's :-

01 Hook's Law verification by Searl's apparatus.

02 Study and demonstration of Universal Testing Machine & its attachments.

03 Tension Test on mild steel/ Aluminum on UTM.

04 Compression test on cast iron on UTM.

05 Direct Shear Test of mild steel on UTM.

06 Brinell Hardness Test on Mild Steel.

07 Rockwell hardness Test on Hardened Steel.

08 Izod & Charpy - Impact tests of a standard specimen.

09 Torsion Test of Mild steel bar.

10 To find Moment of Inertia of a flywheel.

III Semester Diploma in Engineering (Common)

Subject Title : Development of Life Skills- I **Subject Code :302**

Rationale:

In today's competitive world, the nature of organizations is changing at very rapid speed. In this situation the responsibility of diploma holder is not unique. He will be a part of a team in the organization. As such the individual skills are not sufficient to work at his best.

This subject will develop the student as an effective member of the team. It will develop the abilities and skills to perform at highest degree of quality as an individual as well as a member of core group or team. Such skills will enhance his capabilities in the field of searching, assimilating information, managing the given task, handling people effectively, solving challenging problems.

THE SUBJECT IS CLASSIFIED UNDER HUMAN SCIENCE. Objectives: The

students will be able to:

1. Develop team spirit i.e. concept of working in teams
2. Apply problem solving skills for a given situation
3. Use effective presentation techniques
4. Apply techniques of effective time management
5. Apply task management techniques for given projects
6. Enhance leadership traits
7. Resolve conflict by appropriate method
8. Survive self in today's competitive world
9. Face interview without fear
10. Follow moral and ethics
11. Convince people to avoid frustration

CONTENTS: Interaction by faculty / professional

Chapter	Name of the Topic	Suggested HOURS
1	**SOCIAL SKILLS** Society, Social Structure, Develop Sympathy And Empathy.	**01**
2	Swot Analysis – Concept, How to make use of SWOT.	**01**
3	**Inter personal Relation** Sources of conflict, Resolution of conflict , Ways to enhance interpersonal relations.	**02**

4	**Problem Solving** **I)STEPS IN PROBLEM SOLVING,** 1)Identify and clarify the problem, 2)Information gathering related to problem, 3)Evaluate the evidence, 4)Consider alternative solutions and their implications, 5)Choose and implement the best alternative, 6)Review **II)Problem solving technique**.(any one technique may be considered) 1) Trial and error, 2) Brain storming, 3) Lateral thinking	**02**
5	**Presentation Skills** Body language -- Dress like the audience Posture, Gestures, Eye contact and facial expression. STAGE FRIGHT, Voice and language – Volume, Pitch, Inflection, Speed, Pause Pronunciation, Articulation, Language, Practice of speech. Use of aids –OHP,LCD projector, white board	**03**
6	**Group discussion and Interview technique** – Introduction to group discussion, Ways to carry out group discussion, Parameters— Contact, body language, analytical and logical thinking, decision making **INTERVIEW TECHNIQUE** Necessity, Tips for handling common questions.	**03**
7	**Working in Teams** Understand and work within the dynamics of a groups. Tips to work effectively in teams, Establish good rapport, interest with others and work effectively with them to meet common objectives, Tips to provide and accept feedback in a constructive and considerate way , Leadership in teams, Handling frustrations in group.	**02**

8	**Task Management** Introduction, Task identification, Task planning ,organizing and execution, Closing the task	**02**
	TOTAL	**16**

CONTENTS: PRACTICAL -

List of Assignment: (Any Eight Assignment)

1) SWOT analysis:- Analyse yourself with respect to your strength and weaknesses, opportunities and threats. Following points will be useful for doing SWOT.
   a) Your past experiences,
   b) Achievements,
   c) Failures,
   d) Feedback from others etc.
2) Undergo a test on reading skill/memory skill administered by your teacher.
3) Solve the true life problem.
4) Form a group of 5-10 students and do a work for social cause e.g. tree plantation, blood donation, environment protection, camps on awareness like importance of cleanliness in slump area, social activities like giving cloths to poor etc.(One activity per group)
5) Deliver a seminar for 10-12 minutes using presentation aids on the topic given by your teacher.
6) Watch/listen an informative session on social activities. Make a report on topic of your interest using audio/visual aids. Make a report on the programme.####
7) Conduct an interview of a personality and write a report on it.
8) Discuss a topic in a group and prepare minutes of discussion. Write thorough description of the topic discussed
9) Arrange an exhibition, displaying flow-charts, posters, paper cutting, photographs etc on the topic given by your teacher.

Note: - Please note that these are the suggested assignments on given contents/topic. These assignments are the guide lines to the subject teachers. However the subject teachers are free to design any assignment relevant to the topic. The **term work** will consist of any eight assignments.

Mini Project on Task Management: Decide any task to be completed in a stipulated time with the help of teacher. Write a report considering various steps in task management.

LEARNING RESOURCES:

BOOKS:

Sr. No	Title of the book	Author	Publisher
1	Adams Time management	Marshall Cooks	Viva Books
2	Basic Managerial Skills for All	E.H. Mc Grath , S.J.	Pretice Hall of India
3	Body Language	Allen Pease	Sudha Publications Pvt. Ltd.
4	Creativity and problem solving	Lowe and Phil	Kogan Page (I) P Ltd

5	Decision making & Problem Solving	by Adair, J	Orient Longman
6	Develop Your Assertiveness	Bishop , Sue	Kogan Page India
7	Make Every Minute Count	Marion E Haynes	Kogan page India
8	Organizational Behavior	Steven L McShane and Mary Ann Glinow	Tata McGraw Hill
9	Organizational Behavior	Stephen P. Robbins	Pretice Hall of India, Pvt Ltd
10	Presentation Skills	Michael Hatton (Canada – India Project)	ISTE New Delhi
11	Stress Management Through Yoga and Meditation	--	Sterling Publisher Pvt Ltd
12	Target setting and Goal Achievement	Richard Hale ,Peter Whilom	Kogan page India
13	Time management	Chakravarty, Ajanta	Rupa and Company
14	Working in Teams	Harding ham .A	Orient Longman

INTERNET ASSISTANCE

1. http://www.mindtools.com
2. http://www.stress.org
3. http://www.ethics.com
4. http://www.coopcomm.org/workbook.htm
5. http://www.mapfornonprofits.org/
6. http://www.learningmeditition.com http://bbc.co.uk/learning/courses/
7. http://eqi.org/
8. http://www.abacon.com/commstudies/interpersonal/indisclosure.html
9. http://www.mapnp.org/library/ethics/ethxgde.htm
10. http://www.mapnp.org/library/grp_cnfl/grp_cnfl.htm
11. http://members.aol.com/nonverbal2/diction1.htm
12. http://www.thomasarmstron.com/multiple_intelligences.htm
13. http://snow.utoronto.ca/Learn2/modules.html
14. http://www.quickmba.com/strategy/swot/

Scheme of Teaching and Examination for

4th Semester of 3 Years Diploma in Automobile Engineering

Duration of Semester : **14 Weeks**
Student Contact Hours : **36 Hrs**
Total Marks : **800**
Effective from : 2017 -18 Session

Sl. No.	Name of Subject	Subject Code	Subject	Teaching Scheme			Examination Scheme					
				L	T	P	Hours of Exam	Full Marks of Subject	Final Exam / committee marks	Internal Assessment	Pass Marks Final / Ext. Exam	Pass Marks in Subjects
1.	Automotive Manufacturing Process	AUT402	Theory	3		-	3	100	80	20	26	40
2.	Auto Engg Drawing	AUT403	Theory	3	-	-	3	100	80	20	26	40
3.	Thermal Engg	MEC404	Theory	3	-	-	3	100	80	20	26	40
4.	Theory of Machine	MEC405	Theory	3	-	-	3	100	80	20	26	40
5.	Automobile Transmission System	AUT404	Theory	3	-	-	3	100	80	20	26	40
6.	Automotive Manufacturing Process Lab	AUT405	Practical	-	-	2	4	50	80	20		40
7.	Auto Engg Drawing	AUT406	Practical	-	-	2	4	50	40	10		20
8.	Theory of Machine Lab	MEC409	Practical	-	-	2	4	50	40	10	-	20
9.	Thermal Engg Lab	MEC410	Practical	-	-	2	4	50	40	10	-	20
10	Auto transmission System Lab	AUT407	Practical			2	4	50	40	10		20
11	Professional Practice II	401	Sessional			4		50	30	20		25
Total Hours of Teaching per week :				**15**		**14**						

Total Marks :	Theory	:		Practical	:		Sessional	:
	L	:	Lecture,	T	:	Tutorial	P	: Practical

Note:
1. Period of Class hours should be of 1 hrs duration as per AICTE norms.
2. Remaining Hrs every week has been marked for students for Library and Student Centered Activities.
3. Drawing / Graphics / Practical / Sessional examinations will be held at parent institution.
4. Board will depute examiner for Practical examination.
5. Regarding sessional examination the parent institution will form a three member committee and this committee will examine the sessional records and hold viva of the examinee for 60 % marks allotted to the subject. Marks for remaining 40 % will be provided by the Faculty concerned on the basis of evaluation of each job / work throughout the semester.

AUTOMOTIVE MANUFACTURING PROCESS

L T P — Total Theory Hrs 42
3 2 — F M 100 Th , 50 Pr

1.0 Forging Process **6**

1.1 Forging operations, types of forging – Smith forging, drop forging, press forging, machine forging.
1.2 Forging defects, types.
1.3 Forging by open and close dies.
1.4 Forging sequences for connecting rods, crankshafts, camshafts, spanners and gears

2.0 Sheet metal operations & Dies **4**

2.1 Press tool operations and classifications, shearing action, shearing operations
2.2 Drawing, spinning, bending, stretch forming, embossing and coining
2.3 Types of Dies, Die construction, parts of standard die set
2.4 Press components used in automobiles

3.0 Metal Fabrication **8**

3.1 Classification, types of welding joints, welding terminology
3.2 Principle of gas welding, gas welding equipments, gas cutting, types of flames
3.3 Principle of Arc welding, Arc welding equipments, Electrodes & its types, Manual Metal Arc Welding, TIG, MIG
3.4 Principle of resistance welding, heat balance, electrodes for resistance welding, resistance spot welding, resistance seam welding, resistance projection welding
3.5 Aluminium and cast iron welding, brazing and braze welding, soldering, plasma arc welding and its application pertaining to automobile industry

4.0 Surface treatment and finishing process **6**

4.1 Introduction, surface cleaning processes - blasting, tumbling, alkaline, acid and electrolytic cleaning.
4.2 Surface coating processes : Electroplating, galvanizing, metal spraying, painting
4.3 Surface finishing processes- lapping, honing, super finishing, buffing, burnishing, barrel tumbling, powder coating, polishing

5.0 Machining Process **10**

5.1 Lathe, function of lathe, types of lathe, description and functions of lathe parts. Lathe operation
5.2 Drilling machine, types, drilling machine operations, drilling machine tools, drill size, drill material
5.3 Grinding machine, kinds of grinding, types of grinders, grinding operations, grit, grade, structure of wheels, wheel shapes and sizes
5.4 Milling machines, types of milling machine, principal parts, mechanism, operations.
5.5. Shaper, types of shaper, principal parts, shaper mechanism, shaper operations, shaper tools

6.0 CNC Machines **4**

6.1 NC & CNC machines
6.2 Types of CNC machines
6.3 Advantages and disadvantages of CNC machines
6.4 Working principle of CNC machines
6.5 Principle of computer aided part programming, Do, Loop, Subroutine, Canned Cycle

7.0 Advanced Manufacturing Process **4**

7.1 Use of EDM, ECM, ECG, USM, PAM, LBM for manufacturing of automobile Components
7.2 Introduction to powder metallurgy.
7.3 Introduction to Robotics in automobile manufacturing.

Books

1. Workshop Technology: Hazara Choudhary
2. Workshop Technology: B S Raghuvanshi
3. Manufacturing Technology: P N Rao
4. Production Technology R K Jain
5. Manufacturing Science : Amitabh Ghosh & Mallick

List of experiments

1. Study and awareness of Safety rules & precautions – Forging shop, Welding shop & Machine shop
2. Prepare a job involving forging operation like making a ring, chisel & screw driver.
3. Prepare a job on sheet metal like making a cylinder , dustbin & box.
4. Prepare a job like Grill, involving electric arc welding.
5. Prepare a job involving brazing operation like joining of wires.
6. Prepare a job involving soldering process, like sheet metal joints
7. Prepare a job which involves coating process like galvanizing, painting, electroplating .
8. Prepare a job on lathe machine involving taper turning, threading, facing, knurling, drilling.
9. Prepare a spur gear by using milling machine and make a hole in the centre of the gear by using drilling machine.
10. Prepare a simple job on shaper machine.
11. Write a simple CNC program and set it on the CNC machine and prepare a simple job.

Auto Engineering Drawing

L	T	P		
2		**2**	**Total PrHrs**	**56**

Total TheoryHrs 28

1.Auxiliaryviews 2+4

1.1 Studyofauxiliaryplanes,

1.2 Projectionofobjectsonauxiliaryplanes.

1.3 Completingtheregularviewswiththehelpofgivenauxiliaryviews

SectionalViews.

1.4 Typesofsections

1.5 Conversionofpictorialviewintosectionalorthographicviews(Simple Machine Parts)

2.**Conversion ofProjections** **3+6**

2.1IntroductiontoOrthographic& Isometric projections.

2.2Conversionofisometric viewintoOrthographicViews(Simple Machine Parts)

2.3 DrawmissingviewfromthegivenOrthographicviews-simplecomponents

2.4ConversionoforthographicviewsintoisometricViews(Simple Machine Parts)

3.Rivet and Riveted Joints **2+4**

3.1Introduction and classification of Fasteners

3.2 Shape of Rivet heads

3,3 Types of Riveted joints

4. ConventionalRepresentation **3+6**

4.1.Standardconventionusing SP–46(1988)

(a)MaterialsC.I.,M.S,Brass,Bronze,Aluminum,wood,Glass, ConcreteandRubber

(b)Longandshortbreak inpipe,rodandshaft.

(c)BallandRollerbearing,pipejoints,cocks,valves,internal/ Externalthreads.

(d)Varioussections-Half,removed,revolved,offset,partialandalignedsections.

(e)Knurling,serratedshafts,splinedshafts,and chainwheels.

(f) Springswithsquareandflatends,Gears,sprocketwheel

(g)Countersunk& counterbore.

(h)Tapers

(i) Conventional Representation of holes, bolts, nuts and rivets.

5. Limits,FitsandTolerances: **2+4**

5.1 Characteristicsofsurfaceroughness-Indicationofmachiningsymbolshowingdirectionoflay,roughnessgrades,machiningallowances,manufacturingmethods.

5.2IntroductiontoISO systemoftolerance,dimensional tolerances,elementsofinterchangeablesystem,hole&shaftbasedsystem,limits,fits&allowances.Selectionof fit.

5.3Geometricaltolerances,tolerancesofform andpositionanditsgeometricrepresentation.

6. DetailstoAssembly **7+14**

6.1Introduction

6.2Bearing–FootStepBearing&PedestalBearing

6.3LathetoolPost

6.4Keys, Knuckle Joint and Cotter Joint

6.5ScrewJack
6.6SteamStopValve
6.7 Pipe Joints (Union Joint, Expansion Joint &Spigot & Socket Joint)

7. AssemblytoDetails 7+14

7.1Introduction–
7.2PedestalBearing
7.3 LatheTailStock
7.4DrillingJig
7.5Automotive parts (Piston&connectingrod)
7.6Couplings–Flange Couplings, Flexible Couplings
Universalcouplings&Oldham'sCoupling
7.7Fast&loosepulley
7.8Valve–Notmorethaneightparts

8. Study of Automobile Components Drawing (Minimum 02 sheets) 2+4

Learning Resources:-

a. Book:-

01	N.D.Bhatt	MachineDrawing	CharotarPublication,Anand
02	IS CodeSP46(1988)	Codeofpracticefor general engineeringdrawing.	EngineeringDrawing PracticeforSchooland colleges
03	L.K.Narayanan, P.Kannaich, K.VenkatReddy	ProductionDrawing	NewAgeInternational Publication
04	P.S.Gill	MachineDrawing	S.K.KatariaandSons
05	M.L.Dabhade	EngineeringGraphics(For TopiconAuxiliaryViews)	--
06	Sidheshwar	MachineDrawing	TataMcGrawHill
07	R K Dhawan	Machine Drawing	S Chand

List of Sessionals :-

(Use first angle method of projection)

1. Auxiliary Views

One sheet containing three problems on Auxiliary views.

2. Conversion of projection

i)One sheet containing orthographic to isometric.

ii)One sheet containing isometric to orthographic.

iii) One sheet containing missing view.

3.Rivet and Riveted joints, Conventional Representation as per SP–46 (1988) –one sheet

4.Limit, Fit, Tolerances and Machining Symbols– one sheet

5. Details to Assembly

(i) One sheet covering any one assembly and its details.

(ii) Solve at least two problems as home assignment.

6. Assembly to detailed drawings of components including conventional representation of tolerances and surface finish symbols:

(i) One sheet covering any one assembly and its details

(ii) At least two problems as home assignment.

7. Solve at least two problems on production drawing.

8.Two problems on assembly drawings using any AutoCAD Package.

Course Name : Diploma in Mechanical Engineering

Course code : ME/MH/MI

Semester : Fourth

Subject title : Thermal Engineering

Subject code :

Teaching and Examination Scheme

L	T	P	
3		2	

Total Theory Hrs 42

F M 100 Th , 50 Pr

Rationale:

Mechanical engineers have to work with various power producing & power absorbing devices like boilers, turbines, compressors, pumps etc. In order to understand the principles, construction & working of these devices, it is essential to understand the concept of energy, work, heat & conversion between them .Hence it is important to study the subject of Thermal Engineering which is a core subject. It includes the study of various sources of energy, basic laws & concept of thermodynamics, gas laws, properties of steam & generation. Heat transfer forms the basis for different power engineering application. Boilers find application in different process industries. Steam turbines and condensers are the major component of any steam power plant. Mechanical engineer should understand working and application of these devices.

Objectives: The Students should be able to:

1. Know various sources of energy & their applications.
2. Apply fundamental concepts of thermodynamics to thermodynamic systems.
3. Understand various laws of thermodynamics.
4. Apply various gas laws & ideal gas processes to various thermodynamic systems.
5. Calculate properties of two phase system by using steam tables/ mollier charts.
6. Explain construction & working of boilers, mountings & accessories.

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
1.	**Sources of energy** 1.1 Classification of energy sources - Renewable, Non-Renewable 1.2 Fossil fuels,CNG, LPG. 1.3 Solar - Flat plate and concentrating collectors . - Solar Water Heater - Photovoltaic Cell, Solar Distillation	4	
2	**Ideal Gases** 2.1 Concept of Ideal gas, Charle's law, Boyle's law, Avogadro's law, equation of state, Characteristic gas constant and universal gas constant. 2.2 Ideal gas processes: - - Isobaric, Isochoric, Isothermal, Adiabatic, Polytropic, Isentropic with representation of the processes on P-V and	2	
3.	**Fundamentals of Thermodynamics** 3.1 Concepts of pure substance, types of systems , properties of systems, Extensive and Intensive properties.Point function and path function.units of each ,pv=mrT 3.2 Work and Energy - Thermodynamic definition of work, heat, difference between heat and work, P.E., K.E, Internal Energy, Flow work, concepts of enthalpy, entropy. 3.3 Laws of Thermodynamic - Zeroth Law, Temperature measurement, principle of energy conservation, irreversibility, Second Law of Thermodynamics, Kelvin Plank, Clausius statements and their equivalence, Concept of perpetual motion machine 1 and 2. 3.4 Application of Thermodynamic laws	10	
4.	**Steam and Steam Boiler** 4.1 Generation of steam at constant pressure with representation on various charts such as T-H, T-S, H-S, P-	8	

	steam and its determination with Separating calorimeter (no numerical). 4.2 Vapour process : - - constant pressure, constant volume, constant enthalpy, constant entropy (numericals using steam table and Mollier chart), Rankine Cycle 4.3 Steam Boilers: - - Classification of boilers. - Construction and working of		
5.	**Steam Turbines and Condensers** 5.1 Steam nozzle: - - Continuity equation, types of nozzles, concept of Mach number, critical pressure, application of steam nozzles.(simple numerical) 5.2 Steam turbine: - - Classification of turbines, Construction and working of Impulse and Reaction turbine. 5.3 Compounding of turbines, Regenerative feed heating, bleeding of steam, nozzle control governing (with velocity diagrams) (No numerical). 5.4 Steam condenser: - - Dalton's law of partial pressure, function and classification	12	
6.	**Heat Transfer** 6.1 Modes of heat transfer: - - Conduction, convection and radiation. 6.2 Conduction by heat transfer - Fourier's law, thermal conductivity, conduction through cylinder, thermal resistance, composite walls, combined conduction and convection (Simple numerical) 6.3 Heat transfer by Radiation: - - Thermal Radiation, Absorptivity, Transmissivity, Reflectivity, Emissivity, black and gray bodies, Stefan	6	
	TOTAL		

List of Practicals:

1. Collection of technical data and specification of photovoltaic cell by referring to manufacturers catalogues.
2. Study of heat transfer and concept of heat exchanges.
3. Study of solar water heating system.
4. Report on visit to wind power generation plant / biogas plant / hydraulic power plant.
5. Calculation of thermal conductivity of a solid metallic rod.
6. Verification of Stefan-Boltzman's law
7. Study and compare various heat exchangers such as radiators, evaporators, condensers, plate heat exchangers etc.
8. Trace the flue gas path and water-steam circuit with the help of boiler model and write a report.
9. Study of Babcock and Wilcox Boiler/ Lancashire Boiler.
10. Determination of change in velocity of steam with steam nozzle.

Books Recommended

Sr. No.	Author	Title	Publication
01	R. K. Rajput	A Course in Thermal Engineering	Laxmi Publication, Delhi
02	P. L. Ballaney	A Course in Thermal Engineering	Khanna Publishers
03	R. S. Khurmi	A text book of Thermal	S. Chand & co. Ltd.
04	Domkundwar V. M.	A Course in Thermal Engineering	Dhanpat Rai & Co.
	P. K. Nag	Engineering Thermodynamics	Tata McGraw Hill
06	R. S. Khurmi	Steam Table & Mollier Diagram	S. Chand & co. Ltd.
07	Yunus A Cengel	Thermodynamics	

Theory of Machine

L T P **Total Th Hrs 42**
3 2 **F M 100 Th , 50 Pr**

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
1.	**Fundamentals and types of Mechanisms** Kinematics of Machines: - Definition of Kinematics, Dynamics, Statics, Kinetics, Kinematic link, Kinematic Pair and its types, constrained motion and its types, Kinematic chain and its types, Mechanism, inversion, machine and structure. Inversions of Kinematic Chain. • Inversion of four bar chain, coupled wheels of Locomotive & Pentograph. • Inversion of Single Slider Crank chain- Rotary I.C. Engines mechanism, Whitworth quick return mechanism, • Introduction to Inversion of Double Slider Crank Chain - Oldham's Coupling. Common Mechanisms. • Geneva Mechanism. • Ackerman's Steering gear mechanism. (No numericals)	6	
2.	**Velocity and Acceleration in Mechanism** 2.1 Concept of relative velocity, angular velocity and angular acceleration of a point on a link. 2.2 Velocity and acceleration of points and links in mechanisms – relative velocity and instantaneous center method (simple numericals based on analytical method). 2.3 Klein's construction to determine velocity and acceleration of piston of a reciprocating engine.	2	
3.	**Cams and Followers** 3.1 • Concept, definition and application of Cams and Followers. • Classification of Cams and Followers. • Different follower motions and their displacement diagrams like uniform velocity, SHM.	6	

	3.2 Drawing of profile of radial cam of roller follower with and without offset with reciprocating motion		
4.	**Power Transmission** Belt Drives - flat belt, V– belt & its applications, material for flat and V-belt, angle of lap, belt length. Slip and creep. Determination of velocity ratio, ratio of tight side and slack side tension, centrifugal tension and initial tension, condition for maximum power transmission(Simple numerical) • Chain Drives – Advantages & Disadvantages, Selection of Chain & Sprocket wheels, methods of lubrication. • Gear Drives – Spur gear terminology, types of gears and gear trains, train value & Velocity ratio for compound, reverted and simple epicycles gear train, methods of lubrication, Law of gearing. (simple numerical) • Rope Drives – Types, applications, advantages & limitations of Steel ropes.	8	
5.	**Flywheel and Governors** • Flywheel - Concept, function and application of flywheel with the help of turning moment diagram for single cylinder 4-Stroke I.C. Engine (no Numericals). Coefficient of fluctuation of energy, coefficient of fluctuation of speed and its significance. • Governors - Types, concept, function and application & Terminology of Governors.(numericals on Watt governor only) • Comparison between Flywheel and Governor.	6	
6.	**Brakes, Dynamometers, Clutches & Bearings** Brakes and Dynamometers • Function of brakes and dynamometer, types of brakes and Dynamometers, comparison between brakes and dynamometer. • Construction and working of i) shoe brake, ii) Band Brake, iii) Internal expanding shoe brake iv) Disc Brake. • Concept of Self Locking & Self energizing brakes. • Numerical problems to find braking force and braking torque for shoe ***brake.*** • Construction and working of i) Rope Brake Dynamometer, ***Introduction to Hydraulic Dynamometer and Eddy current Dynamometer.***	10	

	Clutches and Bearing • Clutches- Uniform pressure and Uniform wear theories. • Function of Clutch and its application, Construction and working of Single plate clutch, Introduction to Multi-plate clutch, Centrifugal Clutch, ***Cone clutch and Diaphragm clutch.*** (Simple numerical on single plate clutch). • Bearings – i) Simple Pivot, ii) Collar Bearing**.** Torque & power lost in friction (no derivation). Simple numericals		
7.	**Balancing & Vibrations** • Concept of balancing. Balancing of single rotating mass. State the causes and effect of unbalance. • Concept and terminology used in vibration, causes of vibrations in machines, their harmful effects and remedies.	2	
8.	**Gyroscope (Introduction only)** • Gyroscopic motion • Gyroscopic torque • Gyroscopic effects • Application of Gyroscope	2	
	Total	42	

RECOMMENDED BOOKS:

1. The Theory of Machines by Thomas Bevan, CBS Publishers & Distributors
2. Theory of Machine by Saha, Jadavani
3. Theory of Machine by P. L. Ballaney
4. Theory of Machine by R.S. Khurmi
5. Theory of Machine by Abdullah Shariff, Dhanpat Rai & Sons
6. Theory of Machines by SS Ratan
7. Theory of Machine by J E Shigley

List of Practical:

1. To find the ratio of time of cutting stroke to the time of return stroke for quick return mechanism of a shaper machine.
2. Sketch & describe working of bicycle free wheel sprocket mechanism.
3. To find out the height of Governor through Universal Governor Apparatus.
4. Determine the radius of rotation of fly ball for different speed of governor and draw

a graph between radius of rotation versus speed.

5. Draw the Cam profile of various displacement diagrams through Cam Analysis Apparatus.
6. Determination of power transmitted by any belt drive using any one dynamometer.
7. Dismantling and assembly of multi-plate clutch of two-wheeler.
8. Determine graphically balancing of several masses rotating in a single plane.

Diploma in Automobile Engg
IV Semester
Subject – Automobile Transmission System (4thSem)
L T P **Total Hours 42 Th**
3 2 **FM 100 Th 50 Pr**

Chapter	NameoftheTopic	Hours	Marks
01	**Vehicle layout &Clutches** 1.1Vehicle layout&itstypes—2WheelDrive-FrontEngineFrontWheelDrive,RearEngineRearWheelDrive,Front EngineRearWheelDrive&4WheelDrive. • Majorassemblies–theirlocationsandfunctions. 1.2PrincipleandnecessityofClutch. 1.3VarioustypesofclutchesusedinAutomobiles–singleplate, multi-plateclutches-dry&wetclutches,centrifugalclutch,and diaphragmclutch.Materialsused forclutchlining. 1.4Hydraulic&mechanicalclutchlinkage,Cableoperatedclutch linkage. 1.5Fluidcoupling-principle,constructionandworking.	8	
02	**GearBoxes** 2.1 PrincipleandnecessityofGearBox. Types,constructionand workingofgearboxes&their layoutssuchas slidingmesh,constantmesh,synchromesh type, vario-drive,transfercase. 2.2 Gearratioswiththehelpofpowerflowdiagrams. 2.3 Gearshiftmechanism, modern shift control techniques- select shift manual & auto shift manual modes, adaptive transmission control, zero shift transmission technology 2.4 Conceptsofautomaticgearbox, AMT, Types-single & double sided clutch transmission dual clutch transmission, Continuously Variable Transmission. 2.5 TorqueConverter-principle,constructionandworking 2.6 Overdrive, types- control overdrive &laycock overdrive, Lubrication of gear box	8	

Diploma in Automobile Engg
IV Semester
Subject – Automobile Transmission System (4thSem)
L T P **Total Hours 42 Th**
3 2 **FM 100 Th 50 Pr**

03	**Propellershafts, Differential &Rear Axle** 3.1NecessityandfunctionofPropellerShaft. 3.2ConstantvelocityJoints-Inboard&outboardJoints-TripodJoint.Universaljointand slipjoint. 3.3Principle,Necessityandfunctionoffinaldriveanddifferential & transaxle. 3.4Workingofdifferentialanddifferentiallock,Backlashin differential, Limited slip differentials and types 3.5Rear axle drives, Types- HOTCHKISS drive & Torque tube drive 3.6 Typesofrearaxlessuchassemi-floating,threequarterfloatingandfullfloatingtype. 3.7 Rear axle casing , types – split , banjo , integral carrier types.	6	
04	**Front Axle &Steering:** 4.1 Typesoffrontaxle- Dead axle,liveaxle,typeofstubaxlearrangements-Elliot,reverseElliot,lamoine,reverselamoine. 4.2 Steeringmechanisms- Introduction and its Types. 4.3 Steeringgeometry–Caster,camber,kingpininclination,toein–toeout,CorrectSteeringangle.Understeering andoversteering,Turningradius&theireffects. 4.4 Steering Linkages, Construction,working&applicationofSteeringgearbox – rackandpiniontype,recirculatingballtype,worm&rollertype. 4.5Steering Ratio , Powerassistedsteering&itstypes(Hydraulic&electrical) 4.6 Introduction to Four wheel steering. 4.7 Steering adjustment.	6	

Diploma in Automobile Engg
IV Semester
Subject – Automobile Transmission System (4thSem)
L T P **Total Hours 42 Th**
3 2 **FM 100 Th 50 Pr**

05	**Brakes:** 5.1 Function, necessity, Classificationofbrakesandbrakingsystems. 5.2Principle, constructionandworkingof-disc brakes, drum brake. 5.3Constructionandworkingofthefollowing--Mechanical braking, Hydraulic Braking, Air braking, Pneumatic cumHydraulic operated braking, Vacuum cum Hydraulic operated braking system. 5.4Propertiesofbrakefluidsandtheirspecifications 5.5Conceptandworkingofantilockbrakingsystem (ABS), bleeding of hydraulics brakes. 5.6Introduction of Parkingbrake system. 5.7 Brake lining & Its type, Disk brake pad.	6	
06	**SuspensionSystems:** 6.1 Introduction, Functions, Typesofsuspensionsystems-Rigid&independentsuspension 6.2 TypesofIndependentsuspensionsystem-McPhersonstrut,wishbonetype. 6.3 Semi-elliptical Leafspring, coil spring , torsion bararrangement 6.4Telescopicshockabsorber,Gasfilledshockabsorber, hydraulicshock absorber 6.5 AirSuspensionSystem. 6.6 Anti rollbar,stabilizerbar.	4	

Diploma in Automobile Engg
IV Semester
Subject – Automobile Transmission System (4thSem)
L T P **Total Hours 42 Th**
3 2 **FM 100 Th 50 Pr**

07	**WheelsandTyres** 7.1Introduction 7.2Types of wheels, wheel dimensions. 7.3Necessityandtypesoftreads. 7.4Tyre, Properties of tyres, Types of tyres, Carcass types- Cross ply, Radial ply, Belted ply, Comparison of radial &bias-ply tyres, nitrogen in tyres, Tyre materials, Self inflating Tyres.	4	
	Total	**42**	

Practical:

Intellectualskill:

1. Identify concepts applied.
2. Identifypartslikeclutch,gearbox,universaljoints,propellershaft,finaldrivefrontaxle,steering,brakes,and suspensionsystem.
3. Classifythesystemaccordingtotheirapplication.
4. Detectfaultbyobservation.

Motorskill:

1.Sketchthedifferentdevices.

2.Handletools,equipment,andinstrument.

3.Observethebehaviorsofvarioussystemsundervariousparameters.

ListofPractical/Assignments:

1. Dismantling & assembling of a single plate dry clutch assembly and sketch exploded view.
2. Dismantling & assembling of a multi-plate clutch used in two wheelers, observe the operating

Diploma in Automobile Engg
IV Semester
Subject – Automobile Transmission System (4thSem)
L T P **Total Hours 42 Th**
3 2 **FM 100 Th 50 Pr**

linkages and sketch the system.

3. Dismantling &assembling of any two types of gear boxes observe gear shifting, gear ratio and sketch the system & compare them. Open & observe CVT.

4. Open&observeuniversaljointssuchasHooksuniversaljoint.Drawneatsketchof thesame anddescribeit.

5. Dismantling & assemblingthedifferential,sketchtheunitwithbearinglocations.

6. Dismantling & assemblingofanyonetypeofrearaxle.Drawneatsketchofthesameanddescribeit.

7. Dismantling &assembling ofthesteeringgearbox,observethecomponentsandsteeringlinkages and sketch.

8. Dismantling &assembling ofleafspring and sketch.

9. Dismantleand assemble telescopicshockabsorber,observeand sketchitscomponents.

10. Observeanddrawthelayoutofairsuspensionsystem.

11. Observe anddrawlayout of hydraulic brakingsystem. Open mastercylinder, wheelcylinder, andbrakedrum. Observeand sketchthecomponents.

12. Observeanddrawthelayoutofhydraulicallyoperatedairassistedbrakingsystem.

LearningResources: Books:

Sr. No.	Author	Title	Publisher
1	KirpalSingh	AutomobileEngineering Vol.I	StandardPublication
02	AnthonySchwaller	Motorautomotivetechnology	DelmarPublisherInc.
03	TimGills	Automotiveservice	DelmarPublisherInc.
04	AnilChikkara	AutomobileEngineering Vol.II	SatyaPrakashanNewDelhi
05	Crouse/Anglin.	AutomobileMechanics	TATAMcGraw–HILL
06	HarbansSingthRoyat	TheAutomobile	S.ChandPublication
07	R.B.Gupta	AutomobileEngineering	SatyaPrakashanNewDelhi
08	S.Srinivisan	AutomotiveMechanics	TATAMcGraw–HILL
09	HMSETHI	AutomotiveTechnology	TATAMcGraw–HILL

Diploma in Automobile Engg
IV Semester
Subject – Automobile Transmission System (4thSem)

L	T	P	Total Hours 42 Th
3		2	FM 100 Th 50 Pr

IV Semester Diploma in Engineering (Common)

Subject Title : Professional Practices-II **Subject Code : 401**

Rationale:

Most of the diploma holders join industries. Due to globalization and competition in the industrial and service sectors the selection for the job is based on campus interviews or competitive tests.

While selecting candidates a normal practice adopted is to see general confidence, ability to communicate and their attitude, in addition to basic technological concepts.

The purpose of introducing professional practices is to provide opportunity to students to undergo activities which will enable them to develop confidence. Industrial visits, expert lectures, seminars on technical topics and group discussion are planned in a semester so that there will be increased participation of students in learning process.

Objectives:

Student will be able to:

1. Acquire information from different sources
2. Prepare notes for given topic
3. Present given topic in a seminar
4. Interact with peers to share thoughts
5. Prepare a report on industrial visit, expert lecture

Sl	Activity Heads	Activities	Suggested Hrs
1	Acquire information from different sources	Topic related to the branch and current area of interest i.e. articles in internet on which research or review is undergoing may be decided for the students group. The group may be restricted to maximum 5 students. Literature survey from Internet , print media and nearby practices may be undertaken. Minimum of 10 to 15 papers may be suggested for reading to get an overview and idea of matters.	12
2	Prepare notes for given topic	Making review or concept to be penned down in form of a article .(the article or review may be of 8 – 10 pages length in digital form of 12 font size in Times New Roman font)	4
3	Present given topic in a seminar	A seminar or conference or work shop on branch related topic is to be decided and all students in group of 5-6 students may be asked to present their views.	4

4	Interact with peers to share thoughts	A power point presentation of the article prepared in stage 2 may be presented before the classmates and faculty members.	4
5	Prepare a report on industrial visit, expert lecture	A topic on best practices and product / software development may be assigned to the student group. The group may be asked to prepare a survey, come to opinion making and list out the activities to develop the activities with SWOT analysis.	12

Scheme of Teaching and Examination for

5 th Semester of 3 Years Diploma in Mechanical Engineering Automobile

Duration of Semester : **14 Weeks**

Student Contact Hours : **36 Hrs**

Total Marks : **800**

Effective from : 2017 -18 Session

Sl. No.	Name of Subject	Subject Code	Subject	Teaching Scheme			Examination Scheme					
				L	T	P	Hours of Exam	Full Marks of Subject	Final Exam / committee marks	Internal Assessment	Pass Marks Final / Ext. Exam	Pass Marks in Subjects
1.	Transport Rules, Legislation & Act	AUT 503	Theory	3		-	3	100	80	20	26	40
2.	Adv. Automobile Engineering	AUT 504	Theory	3	-	-	3	100	80	20	26	40
3.	Adv. Manufacturing Technology	MEC 504	Theory	3	-	-	3	100	80	20	26	40
4.	Hydraulics & Pneumatics	AUT 505	Theory	3	-	-	3	100	80	20	26	40
5.	Elective I	AUT 506/MEC509/MEC510	Theory	3	-	-	3	100	80	20	26	40
6.	Adv. Automobile Engineering Lab	AUT 507	Practical	-	-	2	4	50	40	10	-	20
7.	Adv. Manufacturing Tech. Lab	MEC 512	Practical	-	-	2	4	50	40	10	-	20
8.	Hydraulics & Pneumatics Lab	AUT 508	Practical	-	-	2	4	50	40	10	-	20
9.	Elective-I Lab	AUT509/MEC517/MEC518	Sessional	-	-	2	-	50	30	20	-	25
10.	In Plant Training	502	sessional	-	-	-	-	50	30	20	-	25
11.	DLS	501	Sessional	-	-	4	-	50	30	20	-	25
Total Hours of Teaching per week :				**15**		**12**						

Elective I (Environment Pollution Control – AUT 506/ CAD/CAM & Robotics – MEC 509/ Installation & Maintenance – MEC 510)

Total Marks: Theory : Practical : Sessional :

L : Lecture, T : Tutorial P : Practical

Note:
1. Period of Class hours should be of 1 hrs duration as per AICTE norms.
2. Remaining Hrs every week has been marked for students for Library and Student Centered Activities.
3. Drawing / Graphics / Practical / Sessional examinations will be held at parent institution.
4. Board will depute examiner for Practical examination.
5. Regarding sessional examination the parent institution will form a three member committee and this committee will examine the sessional records and hold viva of the examinee for 60 % marks allotted to the subject. Marks for remaining 40 % will be provided by the Faculty concerned on the basis of evaluation of each job / work throughout the semester.
6. Inplant Traning of 04 weeks duration to be undertaken after 4th semester Exam and before start of 5th semester classes.

Subject- Transport Rules, Legislation and Acts
Subject Code- AUT503
Hours- 42
Full Marks- 80+20=100

1. **Introduction** - 10 Hrs

1.1 - Motor Vehicles Act, Short titles used in MVA, Definitions, Terms regarding vehicle, Licensing of Driver's of Motor Vehicle - LMV and HMV, Necessity, Age Limit, Responsibility of Owner's, Restriction on Holding a Driving License, General, Preliminary test and Driving test, Conductor's License, Necessity, Eligibility, Documents required and rules for conductor's.

1.2 - Registration of Vehicles- Necessity, Types - Personal and Commercial, Procedure of registration, Production of vehicle at the time of registration, Form and manner of display of Registration Mark, Size of Letters and Numerals of Registration Mark, Transfer of ownership of Motor Vehicle, Registration of Heavy Automotive Equipment.

1.3 - Control of Transport - Transport Authorities, Difference between STA and RTA, Necessity of Permit, All Types of Permit, Transfer of Permit, Temporary Permit, Tourist Permit, National Permit, Speed Limits.

1.4 - Construction of Motor Vehicle - Overall dimensions, General Provision regarding construction and maintenance of motor vehicle, Power of central government to make rules.

1.5 - Taxation - Objectives, Types, Basis of taxation, Method of levying tax, Tax exemption.

1.6 - Insurance - Motor vehicle insurance, Types, No faulty liability, Procedure for accidental claim.

2. **Transport Management** - 10 Hrs

2.1 - Terms used in transportation - Road Transport service, Transport vehicle, Public Service vehicle, Goods vehicle, Public place, Depot, Trip, Time table, Vehicle Schedule, Fare, Comparison of modes of transport, Requirement of goods and passenger transport on the basis of Volume, Type, Weight of Material, Class of Passenger.

2.2 - Basic elements in Transport Management - Market Potential: Type of goods/passengers, Period of use, Probable competition.

Selection of Vehicle: Type of Load, Class of Passenger, Type of service.

Organization set up: Govt, Semi govt, Private.

2.3 - Legal Compliance: Documents required as per MVA, Registration.

Policies of Transport Organization: Policies towards passengers, employees like long distance service, Express service, Night service and others.

Layout of organization: Locations, Elements considered in location, Passenger amenities, Infrastructural facilities.

Scheduling: Basic factors in bus, Crew (staff) and maintenance scheduling, Calculation of number of buses.

2.4 - Freight calculation: Time base, Distance base, Contract, per passenger, cubic feet tone method, Structure of fare, Fixed cost, Maintenance cost, Depreciation cost, Insurance, Interest on Capital, Variable Cost, Hiring of Trucks, Toll Staff Wages, Miscellaneous cost.

2.5 - Record Keeping: Log book, Trip operational sheet, Vehicle ledger, Truck history card, Monthly operational sheet, Goods consignment note, Various types of bookings, Use of computer.

3. **Estimation and Valuation of vehicle** - 10 Hrs

3.1 - Role of surveyor, Procedure of survey and valuation of vehicle, Accident survey report, Importance of warranty system and protection of law, How to deal with defects, Benefits of warranty system, Protection of law.

3.2 - Factors to be considered while buying a new vehicle: Ex show room price and on road price, use of vehicle, When and where to buy, Closing the deal, Running in, Inspecting the vehicle.

Points to check: Test drive, Controls, Bonnet, Suspension, Switches, Seat, Noise, Ventilation, Safety, Boot, Interior storage.

3.3 - Buying a used vehicle: When and where to buy, Dealers, Used car firms, Private sellers, Garages, Auctions.

Factors to be considered: Documentation, Depreciation, Model and year, Oil leak, Oil pressure, Exhaust, Battery, Odometer, Bonnet, Crash damage, Rust, Suspension damage, Tyres, Switches and Accessories, Lights, Chrome, Wiring, Steering, Hydraulic system, Structural corrosion, Floor, Test drive.

3.4 - Preparations for selling: When and how to sell, Auctions, Garages, Private sale, Preparing the car, Documentation, Selling price, Safeguards.

4. **Driving Skills** - 4 Hrs

4.1 - Instructions in driving of motor vehicle: Driving theory, Traffic education, Light vehicle driving practice, Vehicle mechanism and repair, Public relations for drivers, Fire Hazards, Vehicle maintenance, First Aid.

4.2 - Traffic Signs: Mandatory signs, Cautionary signs, Informatory signs, Traffic signals, Causes of accident and remedies.

Measures to avoid accidents.

Defensive driving during rain, flood, fog, mist, snow, ice.

Fitness to drive: Driving and age, Stress due to traffic jam, Night driving.

5. **Motor Industry** - 4 Hrs

5.1 - The automobile industry in India, Importance of Automobile Engineer, Working of various State Transport Organization.

6. **Functions and Role in Automobile Industry** - 4 Hrs

6.1 - Various Research Organizations like

Central Institute of Road Transport,

Automotive Research Association of India,

Vehicle Research, Development & Establishment,

Central Road Research Institute,

Petroleum Conservation & Research Association.

Reference Books

1. Book of the Car — Drive Pub ltd, Automobile Association
2. Vahan Mitra — Bharat Kalaskar Sanjeevni Prakashan Pune
3. Industrial Organization & Management — O P Khanna, Dhanpat Rai & ons
4. Bus and Crew Scheduling — P sudharsanam CIRT Pune
5. Bus Station Management — P sudharsanam CIRT Pune
6. Passenger Amenities in STU — P sudharsanam CIRT Pune
7. Fare Structure in STU — P sudharsanam CIRT Pune
8. Motor Vehicle Act 1988 — Bare Act
9. Central Motor Vehicle Rules 1989 — Bare Act

Subject	Advanced Automobile Engineering
Subject Code	AUT504
Hours	42
Full Marks	100

1. **Engine** - 4 Hrs

1.1- Square engine, Wankel engine, Alkinson cycle engine, Miller cycle engine, automotive gas turbine, Homogenous charge compression ignition engine, Electric vehicle

1.2- Hybrid vehicle - Introduction, Types of hybrid system, Main components, Advantages, Examples, Diesel Hybrid, Plug in Hybrid, Battery Requirements.

1.3- Wheel Motors, Fuel cell vehicle, Special characteristics of sports car engines, SAE rating, RAC rating, DIN rating, Supporting of engine, e gallon, Miles per gallon equivalent.

2. **Engine construction** - 4 Hrs

2.1- Dura bowl piston technology, Piston coatings, Carboglide ring coating, Valve rotators,

2.2- Variable valve timing technologies (VVT), VTEC technology, Fiat multi air technology, Borg Warner's VEMB, Camless engine, Rotating cylinder valve engine, Mahle's efficiency boosting technologies.

3. **Fuels**- 4 Hrs

3.1- Types, Properties of conventional Fuels - Petrol and diesel

3.2- Alternative fuels - Alcohols, Compressed Natural Gas (CNG), Liquified Natural Gas (LNG), Liquified Petroleum Gas(LPG), Bio diesel, Hydrogen, P-series.

4. **Fuel supply system** - 4 Hrs

4.1- Petrol injection- Mechanical and Electronic injection, Main components of petrol injection system. Bosch motronic gasoline system, DI motronic system, Natural gas motronic, Supercharging, Superchargers and turbochargers.

4.2- Modern common rail fuel injection system, Main components, System details, Engine management in CRS, Bosch third generation CRS, Volvo's iART technology, Unit injector system, Unit pump system, Cold starting device.

5. **Electronic Ignition system** - 4 Hrs

5.1- Introduction, Semi conductor, Diodes, Transistors, Principle of distributor type inductive electronic ignition,

5.2- Pulse generator, Hall effect switch, Optical switch, Ignition advance, Capacitor discharge system, Distributor less ignition,Coil on plug (COP), Corona ignition system.

6. **Clutch** - 4 Hrs

6.1- Single plate clutch with dual flywheel, Centrifugal clutch

6.2- Clutch operation- Electromagnetic operation, Hydraulic operation, Vacuum operation

6.3- Fluid flywheel- Construction, Torque transmission, Characteristics, Advantages, Disadvantages.

7. **Gear Box** - 4 Hrs

7.1- Automatic transmission, Epicyclical gear box, Free wheel unit, Torque convertor, Automatic transmission - principle, Evolution, Overdrives, Control of the overdrive, Lay cock overdrive.

7.2- Continuously variable transmission- Principle, Working, Advantages, Toroidal CVT's, Automated manual transmission- Types, Modern shift control techniques, Audi's DSG manual gear box, Zero shift transmission technology.

8. **Suspension system and steering** - 4 hrs

8.1- Stabilizer or anti roll device, Delphi's active stabilizer bar system, Interconnected suspension system, Air suspension, Hydro elastic suspension.

8.2- Daimler Benz vehicle suspension, Hydra gas interconnected suspension system, Delphi's magneride, Continental electronic air suspension, Bose suspension system,

8.3 Four wheel steering, Articulated steering (Fifth wheel coupling).

9. **Brakes** - 4 Hrs

9.1- Electric brakes, Servo brake system- Servo mechanism, Mechanical servo mechanism, Disc brake with servo action, Power brakes, Brakes with hydraulic booster, Engine exhaust brakes.

9.2- Hill holding device, Electric parking brake, Anti-lock braking system (ABS), Regenerative brake system, Electric- Hydraulic combo brake, Siemen's VDO's electronic wedge brake, Carbon ceramic brakes, Brake system with selection criterion.

10. **Accessories** - 10 Hrs

10.1 Introduction, Direction Indicators, Hazard flasher, Horn, Speedometer, Odometer, Tachometer, Windscreen wiper, Windscreen washer, Wiper-less windscreen, Heated windscreen.

10.2- Ventilating system, Mirrors, Sun visors, Sliding roof, Central locking facility, Power windows, Lockable tank cap, Roof carrier, Winch, Vehicle tracking system.

10.3 Air conditioning- General layout of Air conditioning system, working of the following refrigeration sub systems- thermostatic expansion valve, fixed orifice tube & rotary vane air cycle, evaporator, condenser, accumulator, receiver driers, electromagnetic clutch, reciprocating compressor, scroll & rotary vane compressors. Drive systems for compressors.

Subject- Advanced Automobile Engineering Lab
Subject Code- AUT507

List of Practical:-

1. Study of Variable Valve Timing technologies (VVT) in a given engine. Identify the components and find out the variation in timing of the valve according to engine r.p.m.

2. Find out the r.p.m of the engine, when the compressor of turbocharger starts working. Identify the components of the turbo charger and co-relate the r.p.m of the turbine with engine r.p.m.

3. Measure the voltage in the spark plugs on an electronic ignition system. Also identify all the components.

4. On a centrifugal clutch mechanism note the r.p.m when the clutch gets engage and also note the r.p.m when the clutch gets disengage.

5. Find out the gear ratios in a five speed gear box. Note the reduction in r.p.m of the main shaft in all forward gears and also in reverse gear.

6. Measure the castor angle, camber angle, steering axis inclination, toe in and toe out in a vehicle. Also determine the steering ratio.

7. In a vehicle replace the disc pad in front wheels and brake shoes in rear wheels. Also perform bleeding of brakes.

8. Study of air suspension system. Identify its components and study about the functions of each components.

9. Study of Power window mechanism in a given car.

10. Study of heating, ventilation and air conditioning system in a given car.

Reference Books

1. Same as of Automobile Engine and Automobile Transmission subjects of III and IV semester.

Subject : Advance Manufacturing Processes
Subject Code : MEC 504
Hours : 42
Marks : 80 + 20

Content-

Chapter	Name of the Topic	Hours
01	**Non –traditional machining processes** **1.1 Introduction** Unconventional machining process – Need , Classification , Brief Overview of all techniques (Merits and demerits). **1.2 Mechanical Energy Based Processes** Abrasive Jet Machining (AJM), Water Jet Machining (WJM), Ultrasonic Machining (USM) –Working principles, Equipment used, Process parameters, Applications. **1.3 Electrical Energy Based Process** Electric Discharge Machining (EDM) – Working Principles, Equipment, Process parameters, Electrode / Tool, Power Circuits. Tool wear, Dielectric, Flushing, Wire cut EDM and Applications. **1.4 Chemical And Electro Chemical Energy Based Process** Chemical Machining (CHM) – Etchants , Mask ant (Techniques of Applying mask ants) Process parameters, Applications. Principles of ECM – Equipments, Electrical circuit, Process Parameters and Applications. **1.5 Thermal Energy Based Process** Laser Beam Machining (LBM) ,Plasma Arc Machining (PAM), Electron Beam Machining (EBM) – Principles, Equipment, Types, Beam control techniques and Applications.	**15**
02	**CNC Lathe** Introduction, Classification, advantages, Positioning system Constructional features. Part programming: programming format, word, statement, block, Preparatory and miscellaneous code, Fixed cycles in programming- canned cycle, do- loop, subroutine	**07**

03	**CNC milling machines** 3.1 Concept of CNC milling machine Vertical and horizontal machining centre: Constructional features, Axis identification, Electronic control system. Automatic tool changer and tool magazine. 3.2 CNC programming: Preparatory functions (G code), miscellaneous functions (M code), Part programming Including sub routines and canned cycles with comparison (simple programming based on sub routines) 3.3 Introduction to Computer aided part programming by using APT language.	**08**
04	**Machine Tool Automation:** 4.1 Introduction and Need. 4.2 Single spindle automates, transfer lines. Elements of control system, Limit switches, Proximity switches, Block diagram for feedback and servo control system, 4.3 Introduction to PLC, Block diagram of PLC.	**04**
05	**Internet of things (IoT)** 5.1 Introduction to basic components 5.2 Different commonly used sensing & Actuating devices 5.3 Introduction to Artificial Intelligence (AI) & Expert system in relation to IoT. 5.4 Integration of different system	**04**
06	**Maintenance of Machine Tools**: • Types , need and importance of maintenance activity • Basic maintenance practices for simple machine element, (Bearing, Coupling, Shaft and pulley etc.) • Repair cycle analysis, Repair complexity, Maintenance manual, Maintenance records, Housekeeping. • Introduction to Total Productive Maintenance (TPM).	**04**
	Total	**42**

Subject : Advance Manufacturing Processes Lab
Subject Code : MEC 512
Marks : 50

List of Practical:

1) Two jobs on CNC lathe containing the operations like plain turning, taper turning and curvature.
2) Two jobs on CNC milling having following operations–face milling, slotting.
3) Study and Report on part programming (using part programming and canned cycle) on machining center.
4) Study and Report on machine tool installation procedure.
5) Dismantling and Assembly of any one–
   a) Tailstock on lathe
   b) Apron Mechanism.
6) Dismantling and Assembly of any one–
   a) Tapping attachment on drilling machine.
   b) Lathe Chuck
7) Study and Report on mounting and dismounting procedure of following (any two)–
   a) Milling machine arbor.
   b) Vertical milling head.
   c) Tool post
8) Study and Report on any one of the following USM, CHM.
9) Study and Report on any one of the following EBM, AJM.
10) Study and Report on any one of the following WJM, PAM.

Reference Books:

Sl. No.	Author	Title	Pu
01	Amitabh Ghosh,	Manufacturing Science	East-West Press Pvt.
02	HMT, Bangalore	Production Technology	Tata Mc- Graw Hill
03	Pabla B.S. M. Adithan	CNC machines	New Age international limited.
04	H.P. Garg	Industrial maintenance	S. Chand & Co. Ltd.
05	Lindley R. Higgins	Maintenance Engg. Handbook	Mc Graw Hill
06	Begman, Amsted	Manufacturing Processes	John Willey and Sons.
07	B.L. Juneja	Fundamental of metal cutting and machine tools	New age international limited.
08	Steve Krar, Albert Check	Technology of Machine Tools.	McGraw-Hill International.
09	P.N.Rao	CAD/CAM Principals and Applications	Tata Mc Graw-Hill
10	P.N. Rao	Manufacturing Technology Metal Cutting & Machine tools	Tata McGraw-Hill
11	Jeff Heaton	Artificial Intelligence for Human	
12	S. Russel, P. Norvig	Artificial Intelligence : A modern approach	
13	Ela Kumar	Artificial Intelligence	
14	Dr. Jeeva Jose	Internet of things	Khanna pubs.

Subject : Hydraulics & Pneumatics
Subject Code : AUT505
Full Marks : 80+20=100
Hours : 42

Contents: Theory

Chapter	Name of the Topic	Hours
01	**Fluid Mechanics** 1.1 Overview of fluid properties Ideal fluid , Real Fluid, Specific Weight, Specific gravity, Surface tension, Capillarity, Viscosity. Definitions and applications only. Specifications and standards of hydraulic fluids. Pascal's law. 1.2 Measurement of Pressure Concept of atmospheric pressure, gauge pressure, absolute Pressure and vacuum pressure Pressure Gauges - Piezometer tube, simple and differential manometer, micro – manometer. (No numerical on Manometers.) Bourdon tube pressure gauge.	05
02	**Hydrodynamics** 2.1 Law of continuity. Law of continuity and its applications. 2.2 Bernoulli's Theorem. Energy possessed by the liquid in motion. Bernoulli's theorem and its applications such as Venturimeter, Orifice meter and pitot tube. (Analytical treatment with derivation for measurement of discharge). 2.3 Hydraulic coefficients Concept of Vena Contracta. Coefficient of contraction, coefficient of velocity, coefficient of discharge, Coefficient of resistance. Relation between the hydraulic coefficients. 2.4 Types of fluid flow Steady, unsteady, rotational, irrotational, laminar, turbulent, one, two & three dimensional flow.	07

03	**Hydraulic Devices** 3.1 Simple Hydraulic Devices. Working principles, construction and applications of Hydraulic jack, Hydraulic ram, Hydraulic lift, Hydraulic press. 3.2 Centrifugal Pumps. Types, Construction and working of centrifugal pump Types of casing. Need of priming. Heads, Losses and Efficiencies of Centrifugal Pump. (No Analytical Treatment.) Net positive suction head, Fault findings and remedies. Pump selection. 3.3 Reciprocating Pumps Construction & Working of single & Double Acting Reciprocating pump. Positive & Negative slip. Air vessels - their function & Advantage. Power and Efficiencies of Reciprocation Pump. (No Analytical Treatment.) Power and Efficiencies of Reciprocation Pump**.** (No Analytical Treatment.) Reasons of cavitations and separation. 3.4 Other Pumping Devices. Gear pumps used in hydraulic circuits, Vane type, Screw pumps, Swash plate pump. 3.5 Air Compressors. Reciprocating Compressors. Rotary compressor used in pneumatic circuits	**11**

04	**Basic Components of Hydraulic & Pneumatic Systems** 4.1 Hydraulic & Pneumatic symbols 4.2 Air Motors: Type, construction, working. 4.3 Hydraulic Motors: Type, construction, working. 4.4 Valves: Classifications of valves, poppet, ball, needle, throttle, rotary spool, sliding spool, pressure control, directional control, flow control, sequencing, Non-return valves. (Construction & operation of above valves).	**07**
05	**Accessories of Hydraulic & Pneumatic circuit** 5.1 Filters: Types, function, construction. 5.2 Hoses & Connectors: Type, construction and applications. 5.3 Seals & Gaskets: Types, function, construction.	**05**
06	**Hydro Pneumatic Systems & Circuits** 6.1 Comparison of Hydraulic and pneumatic circuits. 6.2 Hydraulic Circuits: Meter in, Meter out, Bleed off, Sequencing circuit – travel dependant, pressure dependant. Applications of hydraulic circuits: Hydraulic power steering – Reaction piston type, Mobile Hydraulic system and Earthmovers, Hydraulic brake circuit, Hydraulic circuits in shaper and milling machine. 6.3 Simple Pneumatic Circuits. Speed control circuits., Applications of pneumatic circuits – Air brake, Pneumatic power tools.	**07**
	TOTAL	**42**

Subject : Hydraulics & Pneumatics Lab
Subject Code : AUT508

List of Practical:

1. Experimental Verification of Bernoulli's Theorem.
2. Experimental determination of Coefficient of Discharge of Venturimeter / Orifice- meter.
3. Symptoms, faults, causes and remedies in general hydraulic components and circuits.
4. Dismantling and assembly of centrifugal pump and gear pump used in automobile.
5. Construct two simple hydraulic circuits like meter in, meter out, bleed off and involving different valves etc. Using trainer kit and observe the working of those circuits.
6. Construct any two simple pneumatic circuits using trainer kit observe the working of those circuits.
7. Trial on centrifugal pump to determine its discharge and efficiency.
8. Trial on reciprocating pump to determine efficiency.
9. Determination of efficiency of reciprocating air compressor.
10. Determination of efficiency of rotary air compressor.

Books:

SL. No.	Author	Name of Book	Publication
01	Pippengen & Hicks	Industrial Hydraulics	Tata McGraw Hill Int.
02	S. R. Mujumdar	Oil Hydraulic System – Principle and Maintenance	Tata McGraw Hill Co.
03	S. R. Mujumdar	Pneumatics Systems – Principle and Maintenance	Tata McGraw Hill Co.
04	Dr. P. N. Modi Dr. S.M. Seth	Hydraulic and Fluid Mechanics	Standard book house, Delhi
05	V. Thanikacha T.T.T.I. - Chennai	Hydraulics and Hydraulic Machinery	Tata McGraw Hill Co.
06	Harry L. Stewart.	Pneumatics and Hydraulics	D. B. Taraporevala sons & co. private Ltd. Mumbai
07	S. Ramamrutham	Hydraulics, Fluid Mechanics & Fluid Machinery	Dhanpat Rai publishing company
08	Dr. Jagdish Lal	Fluid Mechanics and Hydraulics	Metropolitan books Co. private Ltd. Delhi
09	----------	Vicker's Industrial Hydraulic Manual	Vicker's system international Ltd. Pimpri, Pune – 411018
10	Sameer Shaikh Iliyas Khan	Treaties on Hydraulics Pneumatics Fluid system	R. K. Publication, Kolhapur

Subject : Environmental Pollution and Control (Elective-I)
Subject Code : AUT506
Full Marks : 80+20=100
Hours : 42

1. **Air Pollution** –

1.1 - Introduction, Sources and Classification of Air Pollution, Effects of air pollution on Human Health, Effects of air pollution on Animals, Effects of air pollution on Plants, Effects of air pollution on Economy.

1.2 - Photochemical Air Pollution, Air Quality and Emission Standards, Air Pollution Legislation and Regulations, Air Pollution in Indian Cities.

1.3 - Air Pollution from Major Industrial Operations.

1.4 - Air Pollution due to Automobiles, Euro and Bharat Stage norms, Automotive Emission Control System - PCV, Fuel Vapor Emission Control, Charcoal Canister, EGR, Catalytic Convertors.

1.5 - Control of Air Pollution by Equipment, Smoke and its Control, Control of Gaseous Contaminants, Odours and their Control, Control of Air Pollution by Process Changes.

2. **Water Pollution**

2.1 - Introduction, Sources of Water Pollution, Common Impurities in water, Testing of Water, Collection of water Sample, Physical Test, Chemical Test, Bacteriological test, Standards of Drinking Water, Water Borne Dieses, Maintenance of Purity of Water.

2.2 - Purpose of Water Treatment, Flow Diagram of a Treatment Plant, Functions of units, Theory of Sedimentation, Purpose of Sedimentation, Theory of Coagulation and Flocculation, Sedimentation Tank, Coagulation Tank, Design aspects of Sedimentation Tank.

2.3 - Filtration of water - Theory of Filtration, Classification of filters, Slow Sand Filter, Rapid Sand Filter, Pressure sand filter.

2.4 - Disinfection of water - Necessity of Disinfection, Methods of Disinfection, Disinfection by Boiling, UV Rays, Iodine, Bromine, Excess Lime, Ozone, Potassium Permanganate, Silver, Chlorine.

2.5 - Chlorination - Definition, Action of Chlorine, Application of Chlorine, Forms of Chlorination, Mixing Device of Chlorine, Tests of Residual Chlorine.

2.6 - Water Softening - Definition of Hardness, Types of Hardness, Effects of Hardness, Necessity of Water Softening, Removal of Temporary Hardness, Removal of Permanent Hardness.

2.7 - Miscellaneous Water Treatment - Introduction, Removal of Iron and Manganese, Removal of Colour, Odour and Taste, Fluoridation, Defluoridation, Desalination of Water.

3. Solid Waste Pollution

3.1 - Sources of Solid Waste, Collection and Removal of Solid Waste, Disposal of Solid Waste, Reclamation of Land, Rural Sanitation.

3.2 - Characteristics of Sewage - Introduction, Physical Characteristics, Chemical Characteristics, Biological Characteristics, Sampling of Sewage, Necessity of testing of Sewage, Physical Tests, Chemical Tests, Biological Tests, Decomposition of Sewage, Cycles of Decomposition, BOD, COD.

3.3 - Primary Treatment of Sewage - Introduction, Flow diagram of Primary Treatment, Screens, Grit Chamber, Detritus Tank, Skim jming Tank, Primary Sedimentation Tank.

3.4 - Secondary treatment of Sewage - Introduction, Flow diagram of Secondary Treatment, Aeration Tank, Secondary Sedimentation Tank, Activated Sludge Process, Sludge Digestion Tank, Dosing Tank, Trickling Filter, Chlorination of Sewage, Contact Bed, Intermittent Sand Filter.

3.5 - Miscellaneous treatment of Sewage - Oxidation Pond, Cesspool, Septic Tank, Soak Pit, Design of Septic Tank and Soak Pit.

3.6 - Natural methods of Sewage Disposal - Introduction, Dilution Method, Sewage Farming Method, Self Purification Theory, Sewage Sickness.

3.7 - Sludge Digestion -Introduction, Sludge Digestion Tank, Imhoff Tank.

3.8 - Sludge Disposal - Introduction, Disposal by Drying bed, Disposal on Land, Disposal by Throwing into Sea, Disposal by Lagooning, Disposal by Incineration.

4. Soil Pollution -

4.1 - Chemistry of Soil, Soil Irrigation by Effluents, Agricultural Pollution.

5. Radiation Pollution -

5.1 - Sources and Effects of Radiation, Radiation exposure standards, Radiation Protection, Treatment and Disposal of Radiation Waste.

6. Global Pollution -

6.1 - Green House Effect, Acid Rain, Ozone Depletion Problem.

7. Noise Pollution -

7.1 - Introduction, Adverse Effect of Noise, Sources of Noise, Noise Abatement.

Subject : Environmental Pollution and Control (Elective-I)
Subject Code : AUT509

List of Practical:-

1) To determine the pH of a given water and waste water sample by using digital pH meter.
2) To determine the turbidity of the given sample using Turbidity meter (Jackson Turbidity meter/Digital Turbidity meter.)
3) TodetermineresidualchlorineofagivensampleofwaterbyOrthotolidinetest.
4) To determine fluoride concentration in given water sample
5) To determine the Hardness of given water sample by standard EDTA method.
6) To determine suspended solids, dissolved solids and total solids of given water and waste water sample.
7) To determine the optimum dose of coagulant (Alum) for given sample of raw water by jar test.
8) To determine the dissolved oxygen in a sample of water and waste water sample.
9) To determine Biological Oxygen Demand (5daysBOD) of given sample of waste water.
10) To determine C.O.D. of given sample of waste water.
11) To determine Total suspended particulate matter in the atmosphere using High Volume Sample

Learning Resources: Books:

Sr. No.	Author	Title	Publisher
01	Santosh Garg	Environmental Engineering (Volume I & II)	Khanna Publishers,
02	Kamla A & Kanth Rao D.L.	Environmental Engineering	Tata Mc Graw Hill,
03	Birdie G.S. Birdie J.S.	Water Supply and Sanitary Engineering	Dhanpat Rai & Sons
04	Deo lalikar S.G.	Plumbing–Designand Practice	Tata Mc Graw Hill,
05	Rao M.N. Rao H.V.N.	Air Pollution	Tata Mc Graw Hill,
06	H.M. Raghunath	Ground Water	New Age International
07	Rao & Dutta	Industrial Water Treatment	-------

Subject : CAD-CAM & ROBOTICS
Subject Code : MEC509
Total Marks : 80+20=100
Hours : 42

Rationale:

The need of today's manufacturing industrial world is based on best quality & precision oriented shorter manufacturing cycle time .To satisfy this need the use of CAD/CAM & automation is inevitable. To satisfy industrial need, diploma engineer should be able to cope with CAD/CAM technology. With this intention this subject is introduced in the curriculum. The prerequisites of this subject have been introduced in earlier subjects such as engineering graphics, engineering drawing & mechanical engineering drawing.

Objectives:

Student should be able to:

1. Understand the fundamentals & use CAD.
2. Concept ualized rafting and modeling in CAD.
3. Prepare CNC part programming.
4. Operate CNC machines.
5. Conceptualize Robotics and Robotic Program.

Content-

Chapter	Name of the Topic	Hours
01	**Introduction to CAD/CAM** Role and Need of Computers in industrial manufacturing. Product Cycle, CAD/CAM. CAD/CAM hardware:-Basic structure, CPU, Memory, I/O Devices, Storage devices and system configuration.	05
02	**Geometric Modelling** Requirement of geometric modelling, Types of geometric models. Geometric construction methods:-sweep, solid modeling- Primitives & Boolean operations, free formed surfaces (Classification of surface only),Rapid Prototyping(No numerical treatment)	07
03	IntroductiontocomputernumericalControlIntroduction-NC,CNC,DNC,AdvantagesofCNC,Thecoordinate system in CNC, Motion control system-point to point, straight line, Continuous path (Contouring).Absolute system and Incremental system, Feedback control system, Application of CNC.	05
04	**Part programming** Fundamentals, manual part programming, NC–Words, Programming format, part programming, use of sub routines and do loops, computer aided part programming (APT).	09
05	**Industrial Robotics** Introduction, Types of Robots and their working principle, physical configuration, basic robot motions, technical features such as-work volume, precision and speed of movement, weight carrying capacity, drive system, End effectors, robot sensors. Applications–Material transfer, machine loading, welding, spray coating, processing operation, assembly, inspection.	09
06	**Robot Programming** Introduction, Robot programming, Robot programming techniques, On-line programming, Lead-through programming, Walk-through programming or teaching, Off-line programming, Task-level programming, Motion programming, Requirements for standard robot language, Types of robot languages	07
	Total	**42**

Subject : CAD-CAM & ROBOTICS LAB
Subject Code : MEC517

List of Practical's:

1. Two assignment son CAD for 2D drafting.
2. Two assignments on CAD for 3D Modelling.
3. Manufacturing one turning component on CNC.
4. Manufacturing one Milling component on CNC.
5. At least four assignments on part programming using subroutines do loops for turning component.
6. Atleastfourassignmentsonpartprogrammingusingsubroutinesdoloopsformillingcomponent.
7. Report writing on visit to industry having CNC machine.
8. Report writing on visit to industry having robot Application.
9. Report writing on Robot Programming Language.
10. Write a Robot Program in any language with flow diagram.

Learning Resources: Books:

Sr. No.	Author	Title	Publication
01	P.N. Rao	CAD/CAM Principles and Applications	Tata Mc Graw-Hill
02	Radha Krishna P.& Subramanyam	CAD/CAM/CIM	Wiley Eastern Ltd
03	B.S. Pablaand M.A dithan	CNC Machine	Newage International(P)Ltd
04	Groover M.P.&Z immers Jr	Computer Aided design and manufacturing	Prentice hall of India
05	A.K. Gupta & S.K. Arora	Industrial Automation and Robotics	University Science Press

Subject Installation & Maintenance
Subject Code MEC510
Hours 42
Full Marks 80+20=100

TOPIC WISE DISTRIBUTION OF PERIODS		
Sl. No.	**Topic**	**Periods**
01	Safety	1
02	Generalized procedure of installation	5
03	Maintenance and repair of guide surface	5
04	Mounting, maintenance and repair technique of power transmission devices	8
05	Repair of three jaw chuck and tail stock and cracks in cast iron body	3
06	Seals, packing's ad gaskets	2
07	Re-conditioning of I.C. Engines	4
08	Pumps and air compressors	4
09	Lubrication and Lubricants	3
10	Miscellaneous maintenance	4
11	Hydraulic & Pneumatic system	3
	TOTAL	**42**

RATIONALE:

A mechanical engineering diploma holder is in demand as maintenance supervisor. In the capacity of a supervisor he has to tackle the problem of installation and commissioning of machines. He is expected to plan maintenance schedule and to upkeep machines in operating condition. Spot decision are to be taken about replacement, restoration and recovery of machine parts.

The subject has been designed to develop sufficient knowledge which will keep in developing skill and attitude in students so that when engaged in any industry he may be able discharge his duties in confidence.

OBJECTIVES:

A student after successful completion of the subject will be able to

1. Understand the problem in installation of machine and equipment.

2. Organize the maintenance activities.

3. Develop the knowledge of methods of determining wear.

4. Select repair methods of worn parts and their sequence.

5. Understand the common defects and their repair/restoration and removal of machine parts.

6. Ensure uninterrupted production flow.

COURSE CONTENTS:

1.0 Safety

1.1 Safety in Industry

1.2 Need for safety

1.3 Personal protective equipments

1.4 Fire hazards

1.5 Fire fighting equipments

1.6 First aid

2.0 Generalised Procedure of Installation

2.1 Introduction to installation activities

2.1.1 Location and layout of machines

2.1.2 Positioning of machine

2.1.3 Foundation-Design criteria of foundation-Foundation bolts eye-Foundation bolts: Reg bolts, lewis bolt, cotter bolt, split end bolts-Major activities of foundation work.

2.1.4 Leveling and alignment measuring instruments used in leveling

2.1.5 Grouting

2.1.6 Fitting leveling and test runs

2.2 Test chart

2.2.1 Test chart for a general purpose lathe

3.0 Maintenance and Repair of Guide Surface

3.1 Introduction to guide surface. Types of guide ways.

3.2 Causes of mechanical wear on guide surface. Methods of measuring the extent of wear.

3.3 Checking of guide ways for their straightness, special twist and parallility along the horizontal and vertical planes.

3.4 Setting of universal bridge for controlling guide surface characteristics on prism guide, prism and flat guide, vee and flat guide.

3.5 General method of repair of guide surfaces: scarping, grinding and machining.

4.0 Mounting, Maintenance and Repair Techniques of Power Transmission Devices

4.1 Introduction to different types of keys and their application.

4.1.1 Fitting of keys.

4.1.2 Repair methods of worn out keys.

4.2 Introduction to spline fittings.

4.2.1 Repair, milling, slotting and broaching of splines.

4.3 Introduction to couplings and their types

4.3.1 Common defects of coupling and coupling failure and repair.

4.4 Bearings.

4.4.1 Introduction to plain bearings and anti friction bearings.

4.4.2 Assembly of plain bearings and their mounting techniques.

4.4.3 Limiting wear of the bush used under different load conditions and its rectification by bi-metal lings and babbitting.

4.4.4 Antifriction bearing mounting.

4.4.5 Major failure factors and corrective action.

4.5 Clutches

4.5.1 Introduction to clutches and their types.

4.5.2 Common defects of clutches and their repair.

4.6 Transmission Gears

4.6.1 Introduction to transmission gears with their specific applications.

4.6.2 Gears mounting.

4.6.3 Repair method and checking for correct meshing of the spur gears.

4.7 Belt Drives

4.7.1 Belt joining – endless method, lace joint, metallic joint.

4.7.2 Installation of belts and maintenance of belting.

4.8 Chain drive

4.8.1 Roller chain drive and silent chain drive.

4.8.2 Chain wear and repair, sprocket wear and repairing.

4.8.3 Erection and maintenance of sprockets and chains.

5.0 Repair of Jaw Chuck, Tailstock and Cracks in Cast Iron Body

5.1 Repair & maintenance of three jaw chuck

5.2 Repair of tail stock

5.2.1 Repair of taper hole and wear on guide surface.

5.3 Repair of cracks on C.I. body

5.3.1 Repair of cracks by riveting headless copper screws.

5.3.2. Repair of cracks on machine bed and anvil by hot clapping.

5.3.3 Repair of cracks by araldite or stell on compounds.

6.0 Seals, Packing and Gaskets

6.1 Introduction to static seal (gasket). Classification of seals, dynamic seal, labyrinth seal.

6.2 Application of different types of seals on fixed joints on reciprocating parts, on rotating shaft.

7.0 Reconditioning of I.C. Engine

7.1 Decarburisation

7.2 Reboring of the engine cylinder

7.3 Sleeving

7.4 Crankshaft conditioning

7.5 Replacement of cylinder head packing

7.6 Valve grinding and valve setting

7.7 Operational troubles of a diesel engine-causes and remedies

7.8 Trouble shooting of petrol engines-causes and remedies

8.0 Pumps and Air Compressors

8.1 Introduction to basic elements of centrifugal, reciprocating and gear pumps

8.1.1 Pumping units, connection of pumps with suction lines and discharges line.

8.1.2 Alignment test of pumps and driver shaft.

8.1.3 Preparatory steps of starting a pumping unit, procedural steps for starting, operating and stopping of pumping unit.

8.2 Reciprocating pumps – types, working principles.

8.2.1 Installation of a reciprocating pumps

8.2.2 Caution on opening the pump.

8.3 Air compressors

8.3.1 Introduction to different types of air compressors.

8.3.2 Maintenance schedule of reciprocating compressor.

9.0 Lubrication and Lubricants

9.1 Introduction – function of lubrication, modes of lubrication, boundry lubrication, Fluid Film lubrication, Mixed lubrication of machine.

9.2 Types of lubrication system, lubrication of machine tools, lubricating instruction.

9.3 Properties of lubricants, types of lubricants, additives and selection of lubricants.

10.0 Miscellaneous Maintenance

10.1 Discuss materials and pipe fitting.

10.1.1 Major causes of faults-Leakages, swaying of pipes, water hammer, corrosion.

10.2 Steam piping and fitting arrangement.

10.2.1 Pipe joints, pipe welding, expansion bends, pipe supports.

10.2.2 Pipe line installation, repair of pipe lines.

10.3 Dust collectors-gravity separators, cycle separators, packed tower separators, electrostatic separator and their maintenance

11.0 Hydraulic and Pneumatic system

11.1 Introduction to hydraulic & pneumatic system

11.1.1 Basic circuits

11.2 Maintenance of valves, actuators, pipe lines, motor, pump & compressor

11.3 Safety valves, relief valves & directional valves

Subject Installation & Maintenance Lab
Subject Code MEC518

List of Practical's:

1. Check the alignment & levelling of a machine in the machine shop using different levelling & alignment tools.
2. Check & identify the wear on guide surfaces of a lathe machine and outline the procedure for their correction.
3. Perform a test run on a newly installed machine as per test chart provided.
4. Outline the repair method for a worn out key.
5. Study different types of coupling & their uses.
6. Assemble bearing on a shaft as per mounting procedure.
7. Dissemble and follow the preventive maintenance procedure of tail stock of a lathe machine and reassemble.
8. Dissemble head of a two stroke I.C. Engine and decarburize and reinstall.
9. Dissemble a centrifugal pump and check the conditions of parts of the pump.
10. Identify the different pipe fittings used in piping works.

RECOMMENDED BOOKS

1. Installation, Servicing and Maintenance – by S.N. Bhattacharya – Pub. S. Chand & Co.
2. Industrial Maintenance – by H.P. Garg – S. Chand & Co.
3. Maintenance Management, I.S.T.E., Mysore
4. General Mechanical Engineering – MacGraw Hill (T.T.T.I., Chandigarh)
5. Installation and Maintenance – by H.K. Mishra-Pub 'Rup Prakashan'

Subject Title : Development of Life Skills (Common Paper)
Subject Code : 502
Full Marks : 50

Rationale:

In today's competitive world, the nature of individual and organizations is changing at very rapid speed. In this situation the responsibility of diploma holder is not unique. After completing his course work he has to face the world and seek meaningful employment also. Merely having knowledge is not sufficient these days. He has to show his communicative skill also. As such the individual skills with capability to show his strength and communicate his willingness new skills for further advancement with to impart his ability and acquiring has to be displayed and learned.

This subject will develop the student as an effective individual to grab the available situation and be member of the unseen team in which he may be put in . It will develop the abilities and skills to perform at highest degree of quality as an individual as well as a member of core group or team. Such skills will enhance his capabilities in the field of searching, assimilating information, managing the given task, handling people effectively, solving challenging problems.

Objectives: The students will be able to:

1. Develop acumen to face interview.
2. Lead in the group discussion and set goals and targets for others
3. Develop team spirit i.e. concept of working in teams
2. Apply problem solving skills for a given situation
3. Use effective presentation techniques
4. Apply techniques of effective time management
5. Apply task management techniques for given projects
6. Enhance leadership traits
7. Resolve conflict by appropriate method
8. Survive self in today's competitive world
9. Follow moral and ethics
11. Convince people to avoid frustration

CONTENTS:

SOCIAL SKILLS

1. Social understanding for group discussion, imaginative thinking and develop free ideas .

2. SWOT Analysis – Concept, and know himself in details. Learn how to make use of SWOT.

3. Inter personal Relation:- How to effectively counter arguments of others without hearting their feeling Sources of conflict and conflict resolution, Ways to enhance interpersonal dependence and relations.

4. Problem Solving

I) STEPS IN PROBLEM SOLVING,

1) Identify and clarify the problem,
2) Information gathering related to problem,
3) Evaluate the evidence,
4) Consider alternative solutions and their implications,
5) Choose and implement the best alternative,
6) Review

II) Problem solving technique.(any one technique may be considered)

1) Trial and error
2) 2) Brain storming
3) 3) Lateral thinking

5. Presentation Skills

Body language --
Dress like the audience, Posture, Gestures, Eye contact and facial expression. STAGE FRIGHT,
Voice and language – Volume, Pitch, Inflection, Speed, Pause, Pronunciation, Articulation, Language, Practice of speech. Use of presentation aids, Summarizing the facts

6. Group discussion –

Introduction to group discussion, Ways to carry out group discussion, Parameters— Contact, body language, analytical and logical thinking, decision making

7. INTERVIEW TECHNIQUE

Necessity, Techniques to influence interviews and giving directions, Tips for handling common questions.

8. Working in Teams

Understand and work within the dynamics of a groups.
Tips to work effectively in teams,
Establish good rapport, interest with others and work effectively with them to meet common objectives,
Tips to provide and accept feedback in a constructive and considerate way ,
Leadership in teams, Handling frustrations in group.

9. Task Management

Introduction, Task identification, Task planning ,organizing and execution, Closing the task

BOOKS:

Sr. No	Title of the book	Author	Publisher
1	Adams Time management	Marshall Cooks	Viva Books
2	Basic Managerial Skills for All	E.H. Mc Grath , S.J.	Pretice Hall of India
3	Body Language	Allen Pease	Sudha Publications Pvt.
4	Creativity and problem solving	Lowe and Phil	Kogan Page (I) P Ltd
5	Decision making & Problem Solving	by Adair, J	Orient Longman
6	Develop Your Assertiveness	Bishop , Sue	Kogan Page India
7	Make Every Minute Count	Marion E Haynes	Kogan page India
8	Organizational Behavior	Steven L McShane and Mary Ann Glinow	Tata McGraw Hill
9	Organizational Behavior	Stephen P. Robbins	Pretice Hall of India, Pvt Ltd
10	Presentation Skills	Michael Hatton (Canada – India Project)	ISTE New Delhi
11	Stress Management Through Yoga and Meditation	--	Sterling Publisher Pvt Ltd
12	Target setting and Goal Achievement	Richard Hale ,Peter Whilom	Kogan page India
13	Time management	Chakravarty, Ajanta	Rupa and Company
14	Working in Teams	Harding ham .A	Orient Longman

INTERNET ASSISTANCE

1. http://www.mindtools.com
2. http://www.stress.org
3. http://www.ethics.com
4. http://www.coopcomm.org/workbook.htm
5. http://www.mapfornonprofits.org/
6. http://www.learningmeditition.com http://bbc.co.uk/learning/courses/
7. http://eqi.org/
8. http://www.abacon.com/commstudies/interpersonal/indisclosure.html
9. http://www.mapnp.org/library/ethics/ethxgde.htm
10. http://www.mapnp.org/library/grp_cnfl/grp_cnfl.htm
11. http://members.aol.com/nonverbal2/diction1.htm
12. http://www.thomasarmstron.com/multiple_intelligences.htm
13. http://snow.utoronto.ca/Learn2/modules.html
14. http://www.quickmba.com/strategy/swot/

Scheme of Teaching and Examination for

6 th Semester of 3 Years Diploma in Mechanical Engineering Automobile

Duration of Semester : **14 Weeks**

Student Contact Hours : **36 Hrs (Max.)**

Total Marks : **800**

Effective from : 2017 -18 Session

Sl. No.	Name of Subject	Subject Code	Subject	Teaching Scheme			Examination Scheme					
				L	T	P	Hours of Exam	Full Marks of Subject	Final Exam / committee marks	Internal Assessment	Pass Marks Final / Ext. Exam	Pass Marks in Subjects
1.	Industrial Engineering & Management	601	Theory	3		-	3	100	80	20	26	40
2.	Heavy Automotive Machineries	AUT 604	Theory	3		-	3	100	80	20	26	40
3.	Automotive Elect. & Electronics	AUT 605	Theory	3	-	-	3	100	80	20	26	40
4.	Aerodynamics & Design	AUT 606	Theory	3	-	-	3	100	80	20	26	40
5.	Elective II	MEC607/AUT607/ AUT608/MEC610	Theory	3	-	-	3	100	80	20	26	40
6.	Automotive Electrical & Electronics Lab	AUT 609	Practical	-	-	2	4	50	40	10	-	20
7.	Aerodynamics & Design Lab	AUT 610	Sessional	-	-	2	-	50	30	20	-	25
8.	Heavy Automotive Machineries Lab	AUT 611	Sessional	-	-	2	-	50	30	20	-	25
9.	Elective II Lab	MEC614/AUT612/ AUT613/MEC617	Sessional	-		2	-	50	30	20		25
10.	Project Work	603	Sessional	-	-	4	-	50	30	20	-	25
11.	Professional Practices	602	Sessional	-	-	4	-	50	30	20	-	25
Total Hours of Teaching per week :				**15**		**16**						

Elective (Mechatronics – MEC 607/ Automobile Air Conditioning –AUT 607/ Vehicle Maintenance.- AUT 608/ Alt. Source of Energy- MEC 610)

Total Marks: Theory : Practical : Sessional :

L : Lecture, T : Tutorial P : Practical

Note:
1. Period of Class hours should be of 1 hrs duration as per AICTE norms.
2. Remaining Hrs every week has been marked for students for Library and Student Centered Activities.
3. Drawing / Graphics / Practical / Sessional examinations will be held at parent institution.
4. Board will depute examiner for Practical examination.
5. Regarding sessional examination the parent institution will form a three member committee and this committee will examine the sessional records and hold viva of the examinee for 60 % marks allotted to the subject. Marks for remaining 40 % will be provided by the Faculty concerned on the basis of evaluation of each job / work throughout the semester.

Subject Name : Industrial Engineering & Management (Common paper)

Subject Code : 601

Full Marks : 80+20= 100

L	T	P
3	0	0

Rationale:

After completion of three years of technical training, Polytechnic students are expected to enter in to the World of Work. The business environment is altogether different and new to the students. A proper introduction and understanding of Business Processes is therefore essential for all Polytechnic students. Management is a subject which deals with basics of Management science required to understand the processes the in Industrial & Commercial environment. This will enable the students of Polytechnic to become familiar and to understand various Business Organizational structures, their functioning and the Role these technicians will have to play in these setups with responsibilities.

Industrial Engineering is concerned with the design, improvement and installation of integrated systems of people, materials, equipment and energy. Polytechnic students must be able to analyze the use and cost of the resources of the organization in order to achieve the objective, i.e. to increase productivity, profits etc. and carryout the policies efficiently and effectively.

Objective :

The students will able to:

1. Familiarize environment in the world of work.
2. Explain the importance of management process in Business.
3. Identify various components of management.
4. Describe Role & Responsibilities of a Technician in an Organizational Structure.
5. Apply various rules and regulations concerned with Business & Social responsibilities of the technician.

Detailed Syllabus

1. **Productivity :** **02 Hrs**

   Production and productivity, importance of productivity, factors affecting productivity, means of increasing productivity.

2. **Plant Layout and Material Handling :** **02 Hrs**

Definition of plant layout, objectives of good plant layout, principles of plant layout, types of plant layout, flow pattern, steps in planning the layout for a new enterprise, definition of material handling, functions and principles of material handling, material handling devices.

3. **Work Study :** **04 Hrs**

Definition, concept and need for work study, objectives of method study and work measurement, basic procedure/steps in method study, recording technique, critical examination, principles of motion economy, stop watch procedure for collecting time study data, including performance rating and allowances, work sampling.

4. **Production Planning and Control (PPC) :** **04 Hrs**

Definition and objectives of PPC, functions of PPC, routing, scheduling, loading, dispatching, production control definition and objectives, principle of sound production control system.

5. **Material, Purchase and Stores Management :** **04 Hrs**

Definition, functions& objectives of materials management, inventory control, economic order quantity (EOQ), ABC analysis. Objectives of purchasing department, buying techniques, purchasing procedure (steps involved in one complete purchasing cycle); functions of stores department, location and layout of stores, receipt and issue of materials.

6. **Quality Control and TQM :** **04 Hrs**

Meaning of quality and quality control, dimensions of quality, quality circle, concept and definition of TQM, elements of TQM, Kaizen, 5 ‘S’ and six sigma.

7. **Management :** **04 Hrs**

Various definition, concept of management, levels of management, administration and management, scientific management by F. W. Taylor. Principles of management (14 principles of Henry Fayol). Functions of management - planning, organizing, coordinating, directing, controlling, decision making.

8. **Organizational Management :** **04 Hrs**

Organization - definition, steps in forming organization. Types of organization. Types of organization - line, line and staff, functions, project type. Departmentation- Organized and decentralized, authority and responsibility, span of control (management). Forms of ownership - proprietorship, partnership, joint stock company, co-operative society, govt. sector.

9. **Human Resource Management :** **06 Hrs**

Personnel Management – Introduction, definition, function. Staffing – Introduction to HR, Introduction to HR Planning, Recruitment procedure. Personnel- Training & Development – Types of training, Induction, Skill enhancement. Leadership & Motivation – Leadership- Styles & types, Motivation- Definition, Intrinsic, &Extrinsic, Moslow's theory of Motivation and its significance. Safety Management – Causes of accident, Safety Procedures. Introduction, Objectives & feature of Industrial Legislation such as – Factory act, ESI act, Workman compensation act, Industrial dispute act and salary & wages.

10. **Financial Management :** **04 Hrs**

Financial Management- Objectives & Functions. Capital Generation & Management- Types of capitals, Sources of finance. Budgets and accounts- Types of budgets, Production budget (including varience report), Labour budget, Introduction to Profit & Loss Accounts (Only concept), Balance sheet etc.

11. **Entrepreneurship :** **04 Hrs**

Concept and definition of entrepreneur and entrepreneurship, factors influencing entrepreneurship, entrepreneurial characteristics, need for promotion of entrepreneurship and small scale industries, steps in setting up a small scale industrial enterprise.

References Books :

1. Industrial Engineering and Management by O. P. Khanna
2. Industrial Engineering and Production Management by M. Mahajan.
   Publisher : Dhanpat Rai Publication (P) Ltd. New Delhi

3. Business Administration and Management by Dr. S. C. Saksena
   Publisher : Sahitya Bhawan, Agra.

Subject : Heavy Automotive Machineries
Subject Code : AUT604
Full Marks : 80+20=100
Hours : 42

1. **Introduction to Automotive Heavy Equipment** - 02 Hrs

1.1 - Introduction, Classification, Uses, Specifications, Shape and size, Operations, Maintenance, Spares, Training, Comparison between common automobile and Automotive Heavy Equipment.

2. **Cooling, Lubrication and Fuel Supply System** - 04 Hrs

2.1 - Introduction, Cooling system - Function, Block diagram, Main components, working.

2.2 - Lubricating system - Function, Block diagram, Components- Oil pump, Pressure Regulator, Oil Filter, Oil cooler, Piston cooling, working.

2.3 - Fuel supply system - Function, PTG and PTR Fuel system- , Block diagram, Components - Fuel tank, primary filter, gear pump, pulsation damper, Magnetic screen, Aneroid valve, Governor, Weight assist plunger, Speed control mechanism, Throttle shaft, Shut down valve, Injector, Special type governors.

3. **Dozer** - 04 Hrs

3.1 - Introduction, Construction, Classification, Components- Blade, Arms, Push arms, Pitch arms, Under carriage units.

3.2 - Transmission- Block diagram and operation, Blade Operations.

3.3 - Hydraulic system- Block diagram and operation, Comparison of cable control and hydraulic control blade operation, Operation of dozer.

4. **Shovel** - 06 Hrs

4.1- Introduction, Construction, Classification.

4.2 - Transmission system - Block diagram and operation, Crowd and bucket hoist shaft, Boom hoist shaft, Swing and propel shaft.

4.3 - Undercarriage unit - Block diagram and operation, Superstructure and its attachment.

4.4 - Hydraulic shovel - Construction, Bottom discharge bucket, Two section bottom dump bucket, Side discharge bucket, Cyclic operation of shovel, Shovel installation.

5. **Front End Loader** - 06 Hrs

5.1 - Introduction, Classification, Construction of wheeled loader and crawler loader, Components- Bucket, Arms.

5.2 - Transmission system - Conventional type, hydrostatic type, Block diagram and working.

5.3 - Hydraulic system -Block diagram and working, Hold position, Raising or lowering bucket, Float position, Tilting position.

5.4 - Steering system - Block diagram and working of wheel mounted, Right turn, Left turn, Neutral, Crawler mounted steering, Operation of loader, Comparison of crawler mounted unit and wheel mounted unit.

6. **Dragline** - 04 Hrs

6.1 - Introduction, Classification, Construction, Components- Bucket construction, Boom, Power transmission system.

6.2 - Walking mechanism - Eccentric type (Mechanical type), Hydraulic Ram type.

6.3 - Installation of dragline, Working cycle of dragline, Starting and stopping procedure, Maintenance, Comparison of dragline and shovel.

7. **Clamshell** - 02 Hrs

7.1 - Introduction, Classification, Construction, Components - Buckets, Grapples, Reeving, Tagline.

7.2 - Operation - Digging, Dumping, Chopping, Signals, Deep digging, Application.

8. **Scraper** - 04 Hrs

8.1 - Introduction, Classification, Construction, Components - Bowl, Apron, Cutting edge.

8.2 - Transmission system - Block diagram and working.

8.3 - Hydraulic system - Block diagram and working, Activities of scraper, Cyclic operation.

9. **Motor Grader** - 06 Hrs

9.1 - Introduction, Classification, Construction, Components - Blade and Circle.

9.2 - Transmission system - Block diagram and working.

9.3 - Steering system - Block diagram and working.

9.4 - Hydraulic system - Block diagram and working, Comparison of mechanical controlled grader and hydraulic controlled grader, Functions of grader, Cyclic operation.

10. **Road Roller** - 02 Hrs

10.1 - Introduction, Classification, Construction.

10.2 - Smooth steel Rollers, Sheep's foot roller, Pneumatic roller, Pad roller, Roller with falling weight, Pendant Tamper, Vibrating compactor, Three axle tandem rollers.

11. **Crane** - 02 Hrs

11.1 - Introduction, Classification, Construction, Application, Stability, High Boom Hazards, Overhead Obstructions, Avoiding other accidents, Breaker Balls.

Subject- Heavy Automotive Machineries Lab

Subject Code- AUT611

List of Practical:-

1. Visit to a mine to observe various operations of Automotive Heavy Equipments. Write a report on the visit.

Book:

1. Jagman Singh — Art of Earth Moving
2. Radichev — Tractors and Automobile
3. Burge — Tractors and their power units
4. Trucker — Earth Moving Plant

Subject : Automotive Electrical & Electronics
Subject Code : AUT605
Full Marks : 80+20=100
Hours : 42

1	**Basic Electrical & Electronics Engineering** **Part A** **AC Fundamentals**: Cycle, frequency, phase, period, max, average, r.m.s. value. Concept of current, voltage, power & energy in R, L, & C circuits Three phase supply: Star & Delta circuit, Line & Phase relationship, power equation. **Measuring Instruments**: Introduction to construction, operation and use of AC & DC ammeter, voltmeter, Wattmeter, energy meter & digital multimeter' **Part B** **Electronic Devices:** Conductor, Insulator and Semiconductor. P and N Type Semiconductor, PN Junction. principle of working and testing procedure – Diode, Zener diode, Power diode, Varactor diode, Half wave, full wave & bridge rectifier. Filters – L, C, L-C, π filter Concept of unregulated power supply, regulated power supply- line regulation & load regulation. **Transistor** Bipolar Junction Transistor (BJT), Transistor as a switch and amplifier, single stage transistor amplifier CB, CE and CC configuration and their applications, Biasing, RC coupled and direct coupled amplifier, their frequency response and application. Field Effect Transistor (FET) – Introduction to JFET & MOSFET, VI characteristics	6
2	**Electrical & Electronic Components** 1. Purpose and operation of electrical components like switches, relays, solenoids, buzzers, and resistors. 2. Purpose of circuit protection devices like fuses, maxi fuses, circuit breakers and fusible links 3. Testing of circuit defects like open circuit, shorts, shorts to grounds, voltage drop. Working of Electromagnetic gauges like temp Gauges, fuel gauge, engine oil pressure gauge, Speedo- meter gauge. 4. Working of electrical accessories like wind shield wiper, washer pumps, blower motor, electro chromic mirror, power window, power seat, power door lock.	6
3	**Battery** 1. Lead acid battery and lithium ion battery–components & operation. 2. Maintenance free battery–construction. 3. Concept of Low maintenance battery. 4. Battery ratings and specifications. 5. Battery maintenance and safety precautions. 6. Capacitor, super capacitor &ultra capacitor- component & operation. 7. Capacitor rating and specification 8. Fuel- cell technology.	04

4	**Starting, Charging and Ignition System** **Starting system:** Condition at starting. Behaviour of starter during starting. Series motor and its characterises. Principle & construction of starter motor. Working of different starter drive units, care and maintenance of starter motor. Starter switch. **Charging system:** generation of direct current. Shunt generator characterises. Armature reaction. Third brush regulation. Cut-out. Voltage and current regulator. Compensated voltage regulator alternators principle and construction aspects and bridge benefits. **Working principle of hybrid and electric vehicle-** parallel, series, combined series-parallel, complex hybrid. **Ignition Systems:** types, construction and working of battery coil and magneto ignition system. Types and construction of spark plugs, electronics system. TCI and CDI ignition system. Advantage of electronics ignition system: Types of solid – state ignition system and their principle of operation, contactless electronics ignition system and electronics spark timing control.	08
5	**Electronics Fuel system** Introduction throttle body injection and multiport or point fuel injection, fuel injection system, injection system control, sensor and actuators of CRDI system. Sensor and actuator: Basic sensor arrangement, types of sensors such as – oxygen sensor, crank angle position sensor, fuel metering/vehicle speed sensor and detonation sensor- altitude sensor, flow sensor. Throttle position sensor. Solenoids, stepper motor and relays.	06
6	**Advanced accessories-fundamentals** 1. Operation of automatic headlight. 2. Operation of automatic rain sensing wiper. 3. Operation of parking sensor and adaptive cruise control. 4. Operation of common anti-theft system 5. purpose and operation of automatic door lock system. 6. Actuator and sensor of ABS,TCS,EBD,ESP	06
7	**Diagnosis of electronic components & Systems** 1. Sensor testing:- Oxygen sensor, Engine coolant sensor, Intake air temp. sensor, Throttle position sensor, Manifold absolute pressure sensor. 2. Electronic fuel Injector testing:-only sound test, Ohmmeter test. 3. On board diagnosis (OBD):- 4. Purpose of (on board diagnostic second generation) OBDII, flash codes of Malfunction indicator light. 5. OBDII terminology:- Drive cycle, Trip, Warm up cycle (Definitions only) 6.3.3 SAEJ2012 standards Diagnostic Trouble Code (DTC):- 5digitsonly 6. Troubles of electronic gauges like.	06
	Total	**42**

Subject : Automotive Electrical & Electronics Lab
Subject Code : AUT609

1. Measure the specific gravity of electrolyte of a battery. Also perform high rate discharge test and load test of battery.
2. In a given alternator identify all its components and perform the following test-
    a. Output test
    b. Regulated Voltage output test
    c. Charging circuit resistance test
    d. Electrical testing of stator and rotor
3. In a starter motor, identify all its components and perform the following test-
    a. Current Draw test.
    b. Voltage Drop test
4. In a multi cylinder engine adjust the ignition timing with strobe (neon light)
5. In an engine inspect spark plug cords. Measure and set the spark plug gap and also measure the voltage at spark plug.
6. In an engine locate and identify all the sensors.
7. In a vehicle locate and identify different switches, relays gauges, solenoids, buzzers and fuses.
8. Assignments On Board Diagnosis.
9. Study of accessories like- windshield wiper, washer pump, blower motor, power window.
10. Study of operation of keyless entry, Anti theft system, Automatic Door lock system.

Books:

1.	Barry Hollenbeck	Automotive Electricity, Electronics & Computer Control	Delmar Publisher
2.	Jack Erjavec, Robert Scharff	Automotive Technology: A System Approach	Delmar Publisher Inc
3.	P.L. Kohili	Automotive Electrical Equipment	Tata McGrew-Hill
4.	Trevor Mellard	Automotive Electronic System	ELBS

Subject : Aerodynamics and Design
Subject Code : AUT606
Full Marks : 80+20=100
Hours : 42

Content:

1. **Introduction to Aerodynamics** -

    1.1 - Scope, historical developments, Resistance to vehicle motion, Performance, Fuel consumption, Performance potential of vehicle aerodynamics.

    1.2 - Engine cooling requirement, Air flow to passenger compartment, Duct for air conditioning, cooling of transverse engine and rear engine.

2. **Shape optimization of Cars** -

    2.1 - Front end modification, Front and rear wind shield angle, Dust flow patterns at the rear.

    2.2 - Effects of gap configuration, Effects of fasteners, Wind Noise, Drag resistance in commercial vehicles.

3. **Design of Cylinder and Piston** -

    3.1 - Choice of material for cylinder and piston, Piston friction, Piston slap.

    3.2 - Design of cylinder, Piston pin, Piston rings.

    3.3 - Piston failures, Lubrication of piston assembly.

4. **Design of Connecting Rod and Crankshaft** -

    4.1 - Material for connecting rod, Determining minimum length of connecting rod, small end and big end design.

    4.2 - Material for crankshaft, Design of crank shaft under bending and twisting, Balancing weight calculations.

5. **Design of Valves and Flywheel** -

    5.1 - Design aspect of intake and exhaust manifolds, Inlet and exhaust valves.

    5.2 - Valve springs, Tappets, Valve train, Materials and design of flywheel.

6. **Design of Clutch** -

    6.1 - Design of single plate clutch, Multiplate clutch.

    6.2 - Energy dissipated, design of clutch components.

7. **Design of Gear Box** -

    7.1 - Performance of vehicle, Total resistance to motion, Traction and tractive effort, Acceleration, Calculation of gear ratios.

    7.2 - Design of three speed gear box, Design of four speed gear box.

8. **Design of Final Drive and Rear Axle** -

    8.1 - Design of propeller shaft, Design details of final drive gearing.

    8.2 - Design details of Full floating, Semi floating and Three quarter floating rear shafts and rear axle housing.

9. **Design of Springs** -

9.1 - Design of coil spring.

9.2 - Design of leaf spring.

10. **Design of Brakes** -

10.1 - Design of drum brakes.

10.2 - Design of disc brakes.

Subject : Aerodynamics and Design Lab
Subject Code : AUT610

List of Practical:-

1. On a drawing sheet design cylinder and piston. Prepare drawing indicating overall dimensions, tolerances, hardness and finish.
2. On a drawing sheet design connecting rod and crankshaft. Prepare drawing indicating overall dimensions, tolerances, hardness and finish.
3. On a drawing sheet design valves and flywheel. Prepare drawing indicating overall dimensions, tolerances, hardness and finish.
4. On a drawing sheet design single plate clutch. Prepare drawing indicating overall dimensions, tolerances, hardness and finish.
5. On a drawing sheet design a three speed gear box. Prepare drawing indicating overall dimensions, tolerances, hardness and finish.
6. On a drawing sheet design final drive. Prepare drawing indicating overall dimensions, tolerances, hardness and finish.
7. On a drawing sheet design rear axle. Prepare drawing indicating overall dimensions, tolerances, hardness and finish.
8. On a drawing sheet design coil spring and leaf spring. Prepare drawing indicating overall dimensions, tolerances, hardness and finish.
9. On a drawing sheet design drum brake. Prepare drawing indicating overall dimensions, tolerances, hardness and finish.
10. On a drawing sheet design disc brake. Prepare drawing indicating overall dimensions, tolerances, hardness and finish.

Book:

Sl. No.	Author	Title	Publication
1	R.K.Jain	Machine Design	Khanna Publication
2	R.S. Khurmi & J. K. Gupta	Machine Design	Eurasia Pub. Hours
3	Pandya & Shah	Machine Design	Dhanpat Rai & Sons
4	P.C. Sharma & D.K. Aggarwal	Machine Design	S.K. Kataria & Sons
5	R.B. Gupta	Auto Design	Satya Prakashan
6	N.K. Giri	Problm in Auto Engg.	Khanna Publication
7	K. M. Aggarwal	Auto Design Problem	Saty Praksahan

Subject : Mechatronics (Elective-II)
Subject Code : MEC607
Full Marks : 80+20=100
Hours : 42

RATIONALE:

The integration of electronics engineering, electrical engineering, computer technology and control engineering with mechanical engineering is increasingly forming a crucial part in the design, manufacture and maintenance of wide range of engineering products and processes. As a consequence there is a need for a diploma engineers to understand systems used in automation

OBJECTIVES:

Students should be able to:

1. Identify various input and output devices in an automated system.
2. Understand and draw ladder diagrams.
3. Write simple programs for PLCs.
4. Interpret and use operations manual of a PLC manufacturer.
5. Use simulation software provided with the PLC.
6. Understand interfacing of input and output device

CONTENTS: Theory

Chapter	Name of the Topic	Hours
1	**Introduction to Sensors, Transducers and Actuators** Principle, working and applications of-Limit switches, proximity switches like inductive, capacitive and optical (deflecting and through beam type), Thumb wheel switches, magnetic reed switches, Optical encoders-displacement measurement, rotary, incremental, opto-couplers. Actuator – solenoids – on-off applications, latching, triggering Types of relays- solid state Types of motors – DC motors, DC brushless motors, AC Motors, stepper motors, servo motors.	06

2	**8085 Microprocessor** Architecture, Pin configuration, working of microprocessor, and applications. Instructions and simple programmes. Introduction to ICs used for interfacing such as–Programmable peripheral devices, USART, memory, keyboard, display – LCD,LED,I/O device, ADC, DAC etc **8051 Microcontroller** Architecture, Pin configuration, working of microcontroller, Applications. Comparison of microprocessor and microcontroller, advantages and disadvantages	08
3	**Programmable Logic Controller (PLC)** Introduction, PLC definition, PLC block diagram, Difference between relay panel and PLC, ,power supply, input/output modules (analog, digital) concepts of sink/source, set/reset, latch/unlatch, advantages and disadvantages, installation , troubleshooting and maintenance	08
4	**Selection of a PLC Programming equipment, Programming formats** Ladder diagrams and sequence listing, large process ladder diagram construction, flowcharting as a programming method, Basic PLC functions, Register basics, timer functions, counter functions, Intermediate functions – Arithmetic functions, number comparison and number conversion functions. Data handling functions- SKIP, Master control relay, Jump, Move, Block move, Table to register and register to table move functions. FIFO and LIFO functions, File Arithmetic and Logic function.	12
5	**ONS and CLR functions and their applications** PLC digital bit functions and applications Sequencer functions and cascading of sequencers PLC matrix functions Discrete and analog operation of PLC, Networking of PLCs. PLC auxiliary commands and functions,	06
6	Online, offline, stop/run modes of operations, uploading/downloading between PLC and PC, Introduction to SCADA and DCS	02
	Total	**42**

Subject : Mechatronics Lab (Elective-II)
Subject Code : MEC614

List of Practical:

Term work shall consist of detailed report on the following experiments:

1. Identification and demonstration of different sensors and actuators.
2. Programme of addition and subtraction using 8085 microprocessor.
3. Programme of BCD operation 8085 microprocessor.
4. Study of PLC and execution of simple commands.
5. Demonstration of the working of various digital to analog and analog to digital converters.
6. Development of ladder diagram, programming using PLC for
   a) Measurement of speed of a motor

   b) Motor start and stop by using two different sensors c) Simulation of a pedestrian traffic controller

7. Execution of programmes for
   a) Simulation of four road junction traffic controller
   b) Lift / elevator control
   c) Washing machine control
   d) Tank level control
8. Trace, interpret and demonstrate working of at least two electro pneumatic systems.
9. Trace, interpret and demonstrate working of at least two electro hydraulic systems.
10. Descriptive study of option available in SCADA & DCS.

Learning Resources: Books:

Sr. No.	Author	Title	Publication
1	Bolton W.	Mechatronics- Electronic control systems in Mechanical and Electrical Engineering	Pearson Education Ltd.
2	Histand B.H. and	Introduction to Mechatronics and	Tata McGraw Hill
3	John W. Webb and Ronald Reis	Programmable Logic Controllers	Prentice Hall of
4	NIIT	Programmable Logic Control – Principles and Applications	Prentice Hall of
5	Kolk R.A. and Shetty D.	Mechatronics systems design	Vikas Publishing, New Delhi
6	Mahalik N.P.	Mechatronics principles, concepts and applications	Tata McGraw Hill Publishing

Subject : Automobile Air-Conditioning (Elective-I)
Subject Code : AUT607
Hours : 42
Full Marks : 80+20=100

1. Introduction (5 Hrs)

1.1. Environmental & safety aspects in heating, ventilation & air-conditioning systems

1.2. Human comfort control- comfort zone, air movement, wind chill factor, odour problems & effect of humidity.

1.3. Heat transfer fundamentals, Requirements of heating, ventilation & air conditioning in cars, multi utility vehicles, heavy passenger vehicles, coaches & cryogenic substances.

1.4 Controlled & uncontrolled ventilation- Working, application & comparison.

2. Comfort heating system& heat load (4 Hrs)

2.1 Function, construction, working, maintenance, general faults & their remedies of

Comfort Heating System, Plain heating, Electric heating, steam heating, hot water Heating, solar heating.

2.2 Heating with humidification & heating with dehumidification.

2.3 Gain load, air change load, product load & miscellaneous load (no numerical), concept of Sensible Heat Factor, RSHF, GSHF.

3. Case & Duct System (5 hrs)

3.1 Construction & Working of Air Intake Section, core section & distribution section.

3.2 Construction & working of Downstream, upstream, split & hybrid.

3.3 Construction & working of rear heating & cooling system.

4. Basic concept of Refrigeration system (6 Hrs)

4.1 Definitions of refrigeration, air-conditioning, ton of refrigeration, COP, expression of COP of ideal refrigerator/heat pump, enthalpy, entropy.

4.2 Types of refrigeration System

4.2.1. Vapour compression refrigeration system (VCRS)- components, operation, T-S & P-H diagram, effect of superheating & under-cooling of refrigerant (simple numerical)

4.2.2. Vapour absorption refrigeration system (simple & practical ammonia-water systems only)—components, operation, T-S & P-H diagram, comparison with VCRS (simple numerical)

4.2.3. Air Refrigeration System—components, operation & applications.

5. Air Conditioning System (10 Hrs)

5.1 General layout of Air conditioning system.

5.2 Construction & working of following refrigeration sub systems thermostatic expansion valve,

fixed orifice tube & rotary vane air cycle system.

5.3 Construction & working of evaporator, condenser, accumulator.

5.4 Receiver driers & accumulator- Types, construction & working

5.5 Construction & working of reciprocating, scroll & rotary vane compressors. Drive systems for compressors

5.6 Construction & working of electromagnetic clutch

5.7 Metering devices- comparison of thermostatic expansion valve & fixed orifice tube.

Types working & comparison of thermostatic expansion valves i.e. valve, block type, internally equalized & externally equalized.

5.8 Functions of thermostatic expansion valve i.e. throttling action, modulating action & controlling action. Construction & working of remote bulb.

6. System control devices & electrical circuits (8 Hrs)

6.1 System controls- Construction & working of typical vacuum system & electronic temperature control system.

6.2 Construction & working of vacuum operated devices i.e. vacuum reserve tank, vacuum restrictor, vacuum motor, check valve & check relays.

6.3 Switches-Construction & working of high-side temperature switch, low-side temperature switch, high- pressure switch, low-pressure switch, pressure regulator, ambient switch & super heat switch.

6.4 Sensors-Construction & working of sun load sensor, outside temperature sensor & in car temperature sensors.

6.5 Construction & working of Aspirator.

6.6 Construction & working of blower clutch control, heater control, and time delay relay for heater control.

6.7 Mode doors and temperature doors.

6.8 Electrical circuits- Typical climate control system & Electronic climate control system, their electrical circuits & working.

7. Repairs & maintenance of Air Conditioning system (10 Hrs)

7.1 Visual & acoustic check, side glass, leak test, temperature test, Procedure of charging & discharging. Moisture removal procedure.

7.2 Service equipments & tools–Vacuum pump, Manifold & gauge i.e. Low side & high side, gauge calibration, recovery unit & recycling unit, Halide (Freon) & Fluorescent leak detector, nitrogen leak test

7.3 Compressor service-Symptoms, faults, cause remedy.

7.4 Electromagnetic clutch service-Symptoms, faults, cause & remedy.

7.5 Performance testing procedure of thermostatic expansion valve & fixed orifice tube.

7.6 Refrigerant lubricants- Properties & types

7.7 Refrigerant- types, Packaging, storage, restrictions, color code & purity test

7.8 Hoses & connectors– construction of system hoses, charging hose with shut off valve & connectors. Retrofitting from CFC-R12 to HFC-134A–need, procedure & Precautions

Subject : Automobile Air-Conditioning Lab (Elective-I)
Subject Code : AUT612

List of Practical:-

1. Demonstration of all parts of all sub systems and assembly and disassembly of three different types of compressors.

2. Identification and use of tools, gauges and equipment for servicing.

3. Demonstration of charging and evacuation of refrigerant from system.

4. Demonstration of leakage testing using soap solution and other techniques.

5. Diagnosis of electrical system faults.

6. Diagnosis of control system faults.

7. Perform lubrication of A.C system.

8. Perform servicing of heating system.

9. Retrofitting from CFC-R 12 to HFC- 134A.

10. Diagnosis of various running faults in car HVAC.

Learning Resources:

1. Basic Refrigeration & air-conditioning—P.N.ANATHANARAYANAN (TMH)
2. Automobile Air Conditioning—BOYCE H. DWIGGINS (Thomson Learning)

Subject : Vehicle Maintenance (Elective-II)
Subject Code : AUT608
Full Marks : 80+20=100
Hours : 42

1. **Auto Workshop Safety** -

1.1- Safety in the shop, Shop layout, Hazards and how to avoid them, Hazards due to faulty work habbits or conditions, Hazards due to equipment defects or misuse, Hand tool hazards, Fire prevention, Fire extinguisher.

1.2 - Shop safety rules, Hazardous materials, Hand protection, Driving cars in the shop, Personal protective equipments.

2. **Auto Workshop Equipments** -

2.1- Hydraulic lift, Hydraulic press, Vehicle washers, Battery charger, Engine analyzer, Wheel balancing machine, Turning Radius Gauge, Camber-Castor- King pin gauge, Toe in gauge.

2.2- Wheel aligning equipment, Tyre changer, Head light beam aligner, Four post hoist, Hydraulic hoist, Workshop crane, Layout of workshop.

3. **Maintenance Management and Maintenance of Engines** -

3.1- Maintenance management and record keeping, Types of maintenance, Maintenance schedules, Job or Repair order.

3.2- Engine maintenance- Cleanliness, Oil and filter, Air filter, Coolant level, Brake fluid, Drive test.

3.3- Dismounting the engine, Engine Disassembly, Troubleshooting of an engine.

4. **Diagnosis and Servicing of Cooling System** -

4.1- Working safely on the cooling system, Diagnosing cooling system troubles, Cause of coolant loss, Causes of engine overheating, Causes of slow warm up.

4.2 Checking coolant level, Testing antifreeze strength, Testing the thermostat, Checking hoses and connections, Checking for exhaust gas leakage into cooling system, Pressure testing the cooling system, Pressure testing the radiator cap, Testing the drive belt.

4.3- Cleaning the cooling system, Bleeding the cooling system, Locating and repairing radiator leaks, Water pump service, Replacing expansion core plugs.

5. **Diagnosis and Servicing of Engine** -

5.1 - Care and cleanliness, Cylinder head and valve service, Valve troubles, Valve sticking, Valve burning, Valve breakage, Valve face wear, Valve seat recession, Valve deposits, Valve adjustments, Adjusting valves on solid lifter OHV engines, Adjusting hydraulic valve lifters on OHV engines, Adjusting valves on OHC engines, Jet valve adjustment, Complete valve service, Cylinder head service, Rocker arm stud service, Rocker arm service, Push rod service, Valve spring inspection, Valve guide service, Valve cleaning and inspection, Valve service, Valve seat service, Cam shaft service, Valve lifter service, Valve installation, Cylinder head installation, Intake manifold installation.

5.2- Preparing to remove pistons and rings, Removing piston and rod assemblies, Separating pistons and rods, Checking connecting rods, Inspecting connecting rod bearings, Inspecting connecting rod journals, Piston service, Piston ring service, Installing connecting rod bearings, Installing piston and rod assemblies, Checking connecting rod bearing clearance, Checking connecting rod side clearance.

5.3- Engine short block, Engine mount service, Engine removal, Crank shaft and main bearing service, Removing main bearing caps, Inspecting main bearings, Checking crankshaft journals, Checking main bearing clearance, Checking crankshaft endplay, Replacing main bearings, Replacing thrust bearing,

Removing the crankshaft, Checking the crankshaft, Cleaning the crankshaft, Cylinder block inspection, Cylinder block cleaning, Cylinder service, Refinishing cylinders, Cleaning cylinders, Installing cylinder liners.

5.4- Tuning of engine- Introduction, Engine tune up, Tune up procedure, Tune up instruments, Types of tune up, Trouble shooting of engine.

6. **Diagnosis and Servicing of Fuel Supply and Lubrication System** -

6.1- Petrol fuel injected system- Fuel system safety cautions, Fuel system visual inspection, Checking fuel injectors, Causes of inoperative fuel pump, Resetting inertia switch, Testing fuel pump pressure and capacity, Testing fuel pressure regulator, Testing fuel injectors, The role of on board diagnostics, Monitored and non-monitored circuits, Retrieving trouble codes, Interpreting trouble codes and scan data, Sensor diagnosis, ECM diagnosis, Servicing the fuel system, Air cleaner service, Fuel filter service, Fuel gauge service, Cleaning fuel injectors, Cleaning throttle body, Throttle body injection service, Port injection serviceTrouble shooting of petrol fuel injected system .

6.2 - Diesel fuel injected system- Diesel fuel system trouble diagnosis, Fuel system visual inspection, Checking fuel injectors, Causes of inoperative fuel pump, Testing fuel pump pressure and capacity, Testing fuel pressure regulator, Testing fuel injectors, Servicing the fuel system, Air cleaner service, Fuel filter service, Fuel gauge service, Cleaning fuel injectors, Trouble shooting of diesel fuel injected system .

6.3- Lubricating system troubles, Oil consumption, Oil pressure light or gauge shows low pressure, Servicing lubricating system, Oil pan service, Oil pump service, Pressure relief valve service, Oil pressure indicators service, Trouble shooting of lubrication system.

7. **Diagnosis and Servicing of Clutch, Gear Box and Drive Line** -

7.1- Clutch troubles, Identifying clutch system bearing noise, Servicing the clutch, Clutch linkage adjustment, Checking for clutch disengagement, Checking clutch pedal free travel, Bleeding clutch hydraulic system, Clutch removal, Inspecting and servicing clutch parts, Clutch installation, Trouble shooting of clutch.

7.2- Manual transmission and transaxle trouble diagnosis, Types of manual transmission and transaxle troubles, Manual transmission troubles, Manual transaxle troubles, Manual transmission maintenance, Manual transmission removal, Manual transmission disassembly and cleaning, Inspecting manual transmission parts, Manual transmission assembly, Manual transmission installation, Manual transaxle maintenance, Manual transaxle service, Manual transaxle removal, Manual transaxle overhaul, Manual transaxle installation.

7.3- Drive shaft and universal joint trouble diagnosis, Drive shaft and universal joint service, CV joint and half shaft trouble diagnosis, CV joint boot inspection, CV joint boot service, Drive axle trouble diagnosis, Drive axle and differential service, Servicing the differential assembly, Servicing limited slip differentials, Trouble shooting of drive line.

8. **Diagnosis and Servicing of Braking System** -

8.1 Caution for working around brake dust, Diagnosing drum brake troubles, Caliper service, Servicing brake disc, Flushing the non ABS hydraulic system.

9. **Diagnosis and Servicing of Suspension System** -

9.1- Suspension system maintenance and trouble shooting, Inspection and service of suspension system, Trouble shooting of suspension system.

10. **Diagnosis and Servicing of Wheels and Tyres** -

10.1- Wheel run out, Wheel balance, Tyre repair, Tubeless tyre repair, Wheel repair, Cautions for servicing tyres, Checking tyre pressure and inflating tyres, Tyre inspection.

10.2- Removing wheels from the vehicle, Tyre rotation, Dismounting the tyre from the rim, Wheel inspection, Replacing tyre valves, Mounting the tyre on the rim, Installing the wheel on the rim.

Subject : Vehicle Maintenance Lab (Elective-II)
Subject Code : AUT613

List of Practical:-

1. In a automatic tyre changer, dismount the tyre from the wheel and then mount the tyre again on the wheel.
2. In a given engine perform the following task:-
    a. Measure the engine oil level.
    b. Replace the lubricating oil filter.
    c. Replace the engine oil.
    d. Clean the oil filter.
    e. Replace the fuel filters.
3. In a given engine perform the following task :-
    a. Check the coolant level.
    b. Pressure test the cooling system.
    c. Pressure test the radiator cap.
    d. Test the drive belt tension.
    e. Replace the coolant.
4. In a given engine perform the following task :-
    a. Measure and note the clearance of inlet and exhaust valves.
    b. Set the valve clearances according to manufacturer's specification.
    c. With a torque wrench tighten the stud nuts of cylinder block and cylinder head in correct procedure and according to manufacturer's specification.
5. In a given engine perform the following task :-
    a. Measure and note the spark plug gap.
    b. Set the gap according to manufacturer's specification..
    c. Clean and test fuel injectors.
6. In a given vehicle perform the following task :-
    a. Bleed hydraulic clutch system.
    b. Replace clutch plate.
    c. Note clutch free pedal play.
    d. Adjust clutch free pedal playaccording to manufacturer's specification.
7. In a given vehicle perform the following task :-
    a. Replace gear oil.
    b. Lubricate sliding joint and universal joint.

c. Replace differential oil.

8. In a given vehicle perform the following task :-

a. Replace brake pads of front wheels.

b. Replace brake shoe of rear wheels.

c. Bleed hydraulic brake system.

9. In a given vehicle perform the following task:-

a. Replace any wheel with spare wheel.

b. Perform tyre rotation.

c. Measure and note tyre pressure of each wheel.

d. Set tyre pressure according to manufacturer's specification.

10. In a given vehicle perform all the task provided in the periodic maintenance chart.

Books:

Sr. No.	Author	Title	Publisher
1	Kirpal Singh	Automobile Engineering Vol. I & II	Standard Publication
2	Anthony Schwaller	Motor automotive technology	Delmar Publisher Inc.
3	Tim Gills	Automotive service	Delmar Publisher Inc.
4	Anil Chikkara	Automobile Engineering Vol. I &II	Satya Prakashan New Delhi
5	Crouse/Anglin.	Automobile Mechanics	TATAMc Graw–HILL
6	Harbans Singth Royat	TheAutomobile	S. Chand Publication
7	R.B. Gupta	Automobile Engineering	Satya Prakashan New Delhi
8	S. Srinivisan	Automotive Mechanics	TATA McGraw–HILL
9	HMSETHI	Automotive Technology	TATA McGraw–HILL

Subject : Alternative Source Energy (Elective-II)
Subject Code : MEC610
Full Marks : 80+20=100
Hours : 42

Content-

1. Introduction to Energy Sources

1.1 Introduction.
1.2 Major sources of energy: Renewable and Non-renewable.
1.3 Primary and secondary energy sources.
1.4 Energy Scenario:
- Prospects of alternate energy sources.
- Need of Alternate energy sources.

2. Solar Energy

2.1 Principle of conversion of solar energy into heat and electricity
2.2 Solar Radiation: Solar Radiations at earth's surface
- Solar Radiation Geometry: Declination, hour angle, altitude angle, incident angle, zenith angle, solar azimuth angle

2.3 Applications of Solar energy: -
- Construction and working of typical flat plate collector and solar concentrating collectors and their applications,
- Advantages and limitations
- Space heating and cooling.
- Photovoltaic electric conversion.
- Solar distillation, Solar cooking and furnace.
- Solar pumping and Green House.
- Agriculture-Solar drying for foods
- (no derivations and numerical)

3. Wind Energy

3.1 Basic Principle of wind energy conversion.
3.2 Power in wind, Available wind power formulation, Power coefficient, Maximum power
3.3 Main considerations in selecting a site for wind mills.
- Advantages and limitations of wind energy conversion.

3.4 Classification of wind mills
- W orking of horizontal and vertical axis wind mills, their comparison
- Main applications of wind energy for power generation and pumping.

4. Energy from Biomass

4.1 Common species recommended for biomass.
- Methods for obtaining energy from biomass

4.2 Thermal classification of biomass
- Gasifier,
- Fixed bed and fluidized
- Application of gasifier

4.3 Biodiesel properties, production and application
4.4 Agriculture waste as a biomass
- Biomass digester
- Comparison of Biomass with conventional fuels

5. Energy Conservation & Management

5.1 Energy scenario in various sectors and Indian economy

5.2 Need and importance of energy conservation and management

5.3 Concept of Payback period, Return on investment (ROI), Life cycle cost, Sankey diagrams, specific energy consumption.

6. Energy Conservation Techniques

6.1 Distribution of energy consumption

- Principles of energy conservation.
- Energy audit
- Types of audit

6.2 Methods of energy conservation

- Cogeneration and its application
- Combined cycle system

6.3 Concept of energy management

6.4 Study of different energy management techniques like

- Analysis of input
- Reuse and recycling of waste
- Energy education
- Conservative technique and energy audit

7. Economic approach of Energy Conservation

7.1 Costing of utilities like steam, compressed air, electricity and water.

- Ways of improving boiler efficiency

7.2 Thermal insulation, Critical thickness of insulation

7.3 Waste heat recovery systems, their applications, criteria for installing unit.

7.4 An introductory approach of energy conservation in compressed air, refrigeration, air conditioning, pumps and fans.

Subject : Alternative Source Energy Lab (Elective-II)
Subject Code : MEC617

List of Practical's-

1) To collect information about global and Indian energy market.

2) To perform an experiment on solar flat plate collector used for water heating.

3) To study and analyze performance of Solar street lighting System.

4) To study construction and working of photo voltaic cell.

5) To study construction, working and maintenance of solar cooker.

6) Visit to plant of solar heating system for hotel/hostel/railway station etc.

7) To study construction and working of horizontal axis wind mill or to visit a nearest wind farm.

8) To visit a biomass/ biogas plant of municipal waste or elsewhere.

9) Perform energy audit for workshop/Office/Home/SSI unit.

10) Study of various waste heat recovery devices.

Books:

Author	Title	Publication
Dr B.H.Khan	Non conventional energy Resources	Tata McGraw Hill
G. D. Rai	Non conventional energy sources	Khanna publication
S. P. Sukhatme	Solar energy	Tata McGraw Hill
H. P. Garg	Solar energy	Tata McGraw Hill
Arrora Domkundwar	Power plant engineering	Dhanpat Rai & co.
P.H. Henderson	India- The energy sector	University Press
D. A. Ray	Industrial energy conservation	Pergaman Press
W. C. Turner	Energy management handbook	Wiley Press
K. M. Mittal	Non-conventional energy source	--
Krupal Singh Jogi	Energy resource management	Sarup and sons

Subject : Professional Practices (Common Paper)
Subject Code : 602

Rationale:

Most of the diploma holders join industries. Due to globalization and competition in the industrial and service sectors the selection for the job is based on campus interviews or competitive tests.

While selecting candidates a normal practice adopted is to see general confidence, ability to communicate and attitude, in addition to basic technological concepts.

The purpose of introducing professional practices is to provide opportunity to students to undergo activities which will enable them to develop confidence. Industrial visits, expert lectures, seminars on technical topics and group discussion are planned in a semester so that there will be increased participation of students in learning process.

Activities to be undertaken:

Students are expected to undertake these activities:

1. Acquire information from different sources (Print and electronic) on the topics of specialization and related to the subjects of II nd and final year. The class is to be divided in groups of not more than five to six students in a group and all groups are to be allotted topic of their choice. The topic should not be repeated to other group for originality of work to be performed by the group. This activity will develop interdependence and leadership among the students.

2. Prepare notes for given topic at point no 1. The notes will be in form of a project report, having all the sections of report. The report should not be of 30 – 50 pages.

3. Prepare presentation and Present the learning and finding on given topic in a seminar. The presentation should be prepared in Power Point module having more than 25 slides. All students should be asked to deal with suitable parts decided by the group itself.

4. Interact with peers to share thoughts. After the final presentation the students should be encouraged to interact with the faculty members, students' fellows and other experts for suggestions and advanced and structured learning.

5. Undertake industrial visit of their area and choice. Prepare a report on industrial visit. Expert lectures on the topic selected may be invited for the students and these expert lectures also the students should be asked to prepare a report and present the same in seminar or have a group discussion before the expert and faculty members.

6. Develop entrepreneurial traits. Students group may be asked to have a field survey and product assessment and analysis for a product of their choice. Prepare a report for all the inputs of their requirement and submit it for evaluation.

7. To prepare for start ups. Expert lectures for exploring this option may be arranged as this is also a viable option and much talked about option for self employment and avail the encouragement by the government.

Based on the above rationales students will advised to develop traits under guidance of dedicated faculty members / mentors.