

5 th Semester of 3 Years Diploma in Mechanical Engineering Automobile

Student Contact Hours : 36 Hrs

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 Training 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

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| 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 magnaride, 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	<p>Non –traditional machining processes</p> <p>1.1 Introduction Unconventional machining process – Need , Classification , Brief Overview of all techniques (Merits and demerits).</p> <p>1.2 Mechanical Energy Based Processes Abrasive Jet Machining (AJM), Water Jet Machining (WJM), Ultrasonic Machining (USM) –Working principles, Equipment used, Process parameters, Applications.</p> <p>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.</p> <p>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.</p> <p>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.</p>	15
02	<p>CNC Lathe</p> <p>Introduction, Classification, advantages, Positioning system</p> <p>Constructional features.</p> <p>Part programming: programming format, word, statement, block, Preparatory and miscellaneous code, Fixed cycles in programming- canned cycle, do- loop, subroutine</p>	07

03	<p>CNC milling machines</p> <p>3.1 Concept of CNC milling machine</p> <p>Vertical and horizontal machining centre: Constructional features, Axis identification, Electronic control system. Automatic tool changer and tool magazine.</p> <p>3.2 CNC programming: Preparatory functions (G code), miscellaneous functions (M code), Part programming</p> <p>Including sub routines and canned cycles with comparison (simple programming based on sub routines)</p> <p>3.3 Introduction to Computer aided part programming by using APT language.</p>	08
04	<p>Machine Tool Automation:</p> <p>4.1 Introduction and Need.</p> <p>4.2 Single spindle automates, transfer lines.</p> <p>Elements of control system, Limit switches, Proximity switches, Block diagram for feedback and servo control system,</p> <p>4.3 Introduction to PLC, Block diagram of PLC.</p>	04
05	<p>Internet of things (IoT)</p> <p>5.1 Introduction to basic components</p> <p>5.2 Different commonly used sensing & Actuating devices</p> <p>5.3 Introduction to Artificial Intelligence (AI) & Expert system in relation to IoT.</p> <p>5.4 Integration of different system</p>	04
06	<p>Maintenance of Machine Tools:</p> <ul style="list-style-type: none"> • 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
	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.	
02		07

03	<p>Hydraulic Devices</p> <p>3.1 Simple Hydraulic Devices.</p> <p>Working principles, construction and applications of Hydraulic jack, Hydraulic ram, Hydraulic lift, Hydraulic press.</p> <p>3.2 Centrifugal Pumps.</p> <p>Types, Construction and working of centrifugal pump</p> <p>Types of casing. Need of priming.</p> <p>Heads, Losses and Efficiencies of Centrifugal Pump. (No Analytical Treatment.)</p> <p>Net positive suction head, Fault findings and remedies. Pump selection.</p> <p>3.3 Reciprocating Pumps</p> <p>Construction & Working of single & Double Acting</p> <p>Reciprocating pump. Positive & Negative slip. Air vessels - their function & Advantage.</p> <p>Power and Efficiencies of Reciprocation Pump. (No Analytical Treatment.)</p> <p>Power and Efficiencies of Reciprocation Pump.</p> <p>(No Analytical Treatment.)</p> <p>Reasons of cavitations and separation.</p> <p>3.4 Other Pumping Devices.</p> <p>Gear pumps used in hydraulic circuits,</p> <p>Vane type, Screw pumps, Swash plate pump.</p> <p>3.5 Air Compressors.</p> <p>Reciprocating Compressors.</p> <p>Rotary compressor used in pneumatic circuits</p>	11
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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 Diseases, 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, Skimming 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) To determine residual chlorine of a given sample of water by Orthotolidine test.
- 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 (5 days BOD) 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 lalakar S.G.	Plumbing–Design and 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. Conceptualized drafting 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	Introduction to computer numerical Control Introduction- NC,CNC,DNC,Advantages of CNC, The coordinate 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 and 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 parallelity 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: scraping, 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, boundary 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, cyclone 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. Disassemble and follow the preventive maintenance procedure of tail stock of a lathe machine and reassemble.
8. Disassemble head of a two stroke I.C. Engine and decarburize and reinstall.
9. Disassemble 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) Brain storming
- 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.learningmeditation.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/>