



**DR. A P J ABDUL KALAM UNIVERSITY,
INDORE**

SYLLABUS

For

DIPLOMA MECHANICAL ENGINEERING

(THIRD YEAR, VI SEM)

Dr. A P J Abdul Kalam University, Indore

DR. A P J ABDUL KALAM UNIVERSITY, INDORE

Syllabus for Diploma Mechanical Engineering

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Unit 1

Introduction to Machine Design: Machine and machine elements, bolt, nut, axle, shaft, bearing, coupling, clutch, belt, rope, chain, gear etc. Specific purpose of piston connecting rod, crank shaft, turbine

blade etc. Factors influencing design of machine elements – Strength stiffness, light weight, wear resistance minimum size, availability, processibility, safety, compliance with standards. Basic design procedure. Selection of mechanism, material, shape and size. Preliminary design, applying checks, revision of design final design. Factors influencing selection of materials. Type of failures, types of forces. Types of loading. Safe design stress and factors of safety.

Unit 2

Design of Machine Elements Subjected to Direct and Shear Loads: Introduction members subjected to direct loads – bolt, column, rod, cotter and knuckle joints, members subjected to shear loads rivet, cotter knuckle pin, root of threaded bolt, coupling, bolt, key. Function, application and design of knuckle and cotter joint.

Unit 3

Design of Machine Elements Subjected to Bending Moment, Twisting Moment and Combined Bending and Twisting Moment: Introduction to pure bending, fundamental equation of pure bending viz : $M/I = f/y = E/R$. Design of shaft, key, flange coupling, leaf and helical spring, pulley arms, axle.

Unit 4

Design of Riveted Joint: Type of fastening - temporary and permanent, types of riveted joint - lap and butt joint, definition of common terms like pitch, back pitch, efficiency, margin. Modes of failure of riveted joints.

Unit 5

Design of Simple Welded Joints: Definition of welding advantages of welding over riveted joints, types of welded joints, strength of the butt weld, types of fillet joints and strength of fillet joint problem solving.

Unit 6

Design of Threaded Joints: Types of threads and their proportions, Types of bolts, proportion of nut and bolt dimensions, design of bolt, designation of threads as per I.S. codes.

Unit 7

Design of Clutch: Pivots and Collars friction. Horse power lost assuming uniform pressure and uniform wear. Clutch- need, classification and construction and working of single and multi plate clutches, horse power transmitted by single and multi plate clutches.

Unit 8

Selection of Rolling and Sliding contact Bearing: Types of rolling contact bearing , Ball bearing Roller bearing, bearing designation, bearing installation. Application of bearing. Basic principle of Hydro dynamic and Hydro static bearing. Bearing modulus and Bearing characteristics number.

References

1. Machine Design by Sharma and Agrawal.
2. Machine Design by R.K. Jain.
3. Machine Design by Shigley..
4. Machine Design by R S Khurmi
5. Introduction to Machine Design by Bhandari Tata Mcgraw Hill
6. Machine Design by Pandya and Shah

List of Experiments

1. Measurement of Different characteristics of an Op-Amp in open loop configuration. (a) Output Resistance (b) Different Input Resistance.
2. Measurement of Differential characteristics of an Op-Amp in open loop configuration. (a)Voltage Gain (b) Unity Gain Bandwidth.
3. Inverting Amplifier : (a) AC analysis (b) DC analysis (c) Unity Gain Buffer
4. Non –Inverting Amplifier: (a) AC analysis (b) DC analysis (c) Unity Gain Buffer
5. Op-Amp as: (a) Adder (b) Subtractor (c) Multiplier (d) divider.
6. Op-Amp as: (a) Integrator (b) Differentiator (c) Inverter (d) Buffer
7. Op-Amp as active Filter : (a) Low pass filter (b)High pass filter (c)Band pass filter
8. Signal Generator using Op-Amp and Timer IC (a) Triangular wave generator (b) Schmitt Trigger
9. Signal Generator using Op-Amp and Timer IC (a) Saw tooth wave generator (b) Ramp generation
10. Oscillator using Op-Amp (a) Wein Bridge Oscillator (b) R.C.Phase Shift Oscillator
11. Sample & hold circuit operation
12. Precision Rectifier using an Op-Amp and Voltage regulations.
13. Phase lock loop as frequency multiplier
14. 4 bit D/A converter addition experiments
15. A/D Converter

Unit 1

Introduction: Meaning of automobile, elements of automobile, classification of automobile, layout of chassis, various operating systems used in automobile.

Unit 2

Auto Engines: Meaning of I.C. Engines, Classification on the basis of cycle, fuel used, ignition system, number of cylinders, number of strokes etc. Otto/ Diesel cycles. Two stroke and four stroke engines, merits and demerits, scavenging comparison of petrol and diesel engines. Cooling systems, firing order. Valve timing diagrams. Engine rating. Lubrication, factors affecting lubrication, Lubrication systems, Fuel Supply system, fuel pump - SPU electric pump. Carburettor, air fuel ratio, Solex and amal carburettor.

Unit 3

Auto Electric System: Wiring diagram of a car and functions of various components used in the electric circuits, function and working principle of a starter and generator, function of voltage current regulator, ignition timing, spark plugs- their classification, gap setting and common ignition troubles, their causes and remedies. Automobile battery - construction and working, electronic ignition system of modern vehicles.

Unit 4

Transmission System: Clutch: necessity, function of its components, Types –single & multi plate and centrifugal clutches, clutch actuating mechanism and fluid flywheel. Gear Boxes : necessity, Types of gear boxes and their working. Importance of gear shifting mechanism, gear box troubles, their causes and remedies.

Unit 5

Final Drives System: Drive mechanism in cars, purpose and working of propeller shaft, construction of propeller shaft. Types of universal joints. Rear axle assembly: function of differential - constructional features and working. Arrangement of semi floating and fully floating rear axle, and their troubles.

Unit 6

Braking system: Introduction, classification of brakes, construction & working of mechanical brake, hydraulic brake, Electric brake, advantages and disadvantages of each type of brakes, Servo brake system.

Unit 7

Front Axle and Steering: Function of front axle, axle type, wheel alignment and its elements toe- in, toe -out. King pin inclination. Ackerman steering principle. Camber and castor angle . Elements of steering - types and working, under and over steering, power steering and advanced steering systems.

Unit 8

Frame and Suspension: Frames : necessity, function, Classification, suspension system, types, leaf, coil spring. Telescopic shock absorber. Air suspension, independent suspension system. Tyres : structure of tyre section, rating of tyres, tyre- pressure measurement, material and specification. Tyre wear and remedies.

Unit 9

Miscellaneous:

(i) Maintenance of Vehicles: need, classification maintenance procedure of engine, transmission system, electrical system, braking system and steering mechanism.

(ii) Garage and Service Station: Types, layout, equipment tools and service procedure.

(iii) Exhaust Gas, Pollutants: Their hazards and controls with reference to motor vehicle act. Motor Vehicle act, registration of vehicles, driving license and Traffic Signals.

References

- 1) Automobiles Engineering Vol. I & II by Dr. Kirpal Singh. (Standard Publisher)
- 2) Automobiles Engineering by R.S. Gupta (Satya Prakashan)
- 3) Automobile mechanism by Joseph Heither
- 4) Automobile Engineering by R. P. Sharma (Dhanpat Rai & Sons)
- 5) Automobile Mechanism by William H. Crouse
- 6) I.C. Engines by Dr. A.C. Rad and S.B. Bechar
- 7) Automobile Engineering- T.R. Banga & Nathu Singh (Khanna Publicers)
- 8) Automobile Engg. – RB. Gupta
- 9) Automobile Engg. – K.M. Agrawal (Vol. I & II)
- 10) Automobile Engineering by Prof. S.M. Pande and K.K. Jain (Deepak Prakashan, Morar Gwalior)
- 11) IS: 202-1602-1960 Code for testing of variable speed I.C. Engines for automobile purpose.
- 12) IS: 1603-1960 Performance of variable speed I.C. Engines for automobile purpose.
- 13) IS : 1634-1964 Helical springs for automobile suspension.
- 14) IS : 2742-1964 Automobile brake lining.
- 15) IS : 3511-1966 Cylinder bore diameters for I.C. Engine.
- 16) IS : 4552-1963 Portable Jacks for automobile, Mechanical and hydraulic.
- 17) IS : 5423-1969 General requirements for hydraulic shock absorbers for automobile suspension, direct acting telescope type.
- 18) IS : 5791-1970 Technical supply conditions for piston ring for IS Engines.
- 19) IS : 4974-1963 Grease nipples, small
- 20) IS : 844-1962 Screw drives.
- 21) IS : 2028-1963 Open jaw Spanners.
- 22) IS : 2030-1971 Box Spanners.

List of Experiments

1. Study of automobile chassis and function of various components.
2. Study of various components used in auto vehicles.
 - (a) Engine
 - (b) Transmission system
 - (c) Final Drive
 - (d) Braking system
 - (e) Electrical system
 - (f) Steering Mechanism
3. Study of various elements of scooter/ car/bus servicing.
4. Engine tuning and adjustment for smooth, idle speed of a scooter/moped/ motor cycle/ car etc.
5. Starting troubles and their rectifications.
6. Rectification procedure for :
 - (a) Air bleeding.
 - (b) Brake adjustment.
 - (c) Problems in Carburettor.
 - (d) Wheel alignment.
7. Battery, servicing and charging.
8. Repair of punctured tyre and re-treading of tyres.
9. Study of auto servicing centre.
 - (a) Layout
 - (b) Instruments/ Tools used
 - (c) Servicing procedures.
10. Visit of a local auto service centre and prepare a report in respect of:
 - (a) Layout
 - (b) Instruments/ Tools used
 - (c) Servicing/ Reconditioning/ Maintenance procedure.
11. Collect specifications for 2/3/4 Wheeler and prepare a comparison table and their manuals.

Unit 1.**Introduction to CAD/ CAM:**

- (i) Automation and its types
- (ii) Definitions: CAD, CAAD CAM, CIM and CAE
- (iii) Concept of CAD/CAM
- (iv) Computers in industrial Manufacturing
- (v) General Design procedure and application of computers in it.
- (vi) Benefits of CAD/CAM.

Unit 2.**Hardware of CAD/CAM System**

- (i) Basic structure
- (ii) Hardware components of CAD workstations and their functions: CPU, Memory devices, input devices, display devices, output devices and storage devices
- (iii) Hardware components of CAM system and their functions: CNC controller and CAD interfacing, CNC components. Conveyers and robot units
- (iv) Functions of each hardware unit in CAM.
- (v) Block diagram of integrated CAD/CAM system.

Unit 3.**Introduction to CAD software:**

- (i) Block diagram of graphics software configuration
- (ii) Functions of a graphic package
- (iii) 2D transformation translation, rotation and scaling with numerical examples
- (iv) 3D Modeling: Wire frame and solid type.

Unit 4.**Introduction to Conventional Numerical Control:**

- (i) Definition of NC
- (ii) Basic components of an NC system: Program, MCU and Machine tools
- (iii) The NC procedure
- (iv) NC coordinate systems, fixed zero and floating zero, Absolute and incremental positioning
- (v) NC motion control systems
- (vi) Components of MCU, Open and closed loop axis positioning systems
- (vii) Applications of numerical control in Machine Tools
- (viii) Advantages of NC systems

Unit 5.**Introduction to NC Programming:**

- (i) NC Part program and different codes used in it: N,G,M,F,S,T codes and co-ordinates.
- (ii) Writing Program blocks using NC program codes
- (iii) Manual and Computer assisted part programming
- (iv) Introduction to NC part programming languages like APT

Different statements in APT language and writing program through it

Unit 6.

NC Control technology:

- (i) Different type of computer controls: CNC, DNC and Adaptive
- (ii) General Configuration, functions, and advantage of CNC, straight and hybrid CNC
- (iii) General Configuration, types, functions, and advantage of DNC, BTR and Special Machine control unit DNC
- (iv) Introduction, types and benefits of adaptive control, ACC and ACO systems

LIST OF REFERENCE BOOKS

- 1) CAD/CAM Computer- Aided Design and Manufacturing by M.P. Groover, & E.W. Zimmer, Sr. (Prentice-Hall of India pvt. Ltd. (EEE), New Delhi, 1986)
- 2) Inside Auto CAD by Deniel Raker and Harbest Rice (BPB Publications, Delhi (Latest edition)
- 3) Introduction to Computer Aided Drafting by Donald D. Voisinet (2nd fd.)McGraw Hill.
- 4) BPB Publications, Delhi. by Mastering Auto CAD (BPB Publications, Delhi)
- 5) Illustrated Auto CAD by T.W. Berghauser and P.L. Schlieve.
- 6) Numerical Control by Marthin (E.L.B.S.)
- 7) Understanding CAD/CAM- Design with Computer by D.J. Bowman, and R.N. MC-Dougal (BPB Publications, Delhi) .
- 8) Numerical Control . by Child.
- 9) CAD/CAM by Kuldeep Sareen & Chandadeep Grewal (S,Chamd & Co, Delhi)
- 10) Computer-Aided Design Engineering & Manufacturing (CRC Press)

LIST OF EXPERIMENTS :-

- 1. Study of CAD Hardware system using physical and visual aid.
- 2 Auto CAD commands and their applications in various types of designs/ drawings.ten/fifteen experiments.
- 3. Solid modeling using parametric software.
- 4. Demonstration of CNC machine for identifying machine zero, drive systems, safety precautions, and dry run of demo part programme.
- 5. Tool setting, Job setting, part programme execution on CNC machine.
- 6. Material job handling using Robot system and conveyor assembly.

Unit 1

Introduction to Refrigeration: History of refrigeration, meaning and need of refrigeration, difference between refrigeration and Cryogenics, production of refrigeration by various methods. Refrigeration systems and their classification on the basis of use, size and application.

Unit 2

Thermodynamics of Refrigeration: Revision of I and II law of thermodynamics, comparison between heat engine, heat pump and refrigerator using heat reservoir, heat source, sinks & work. Unit of refrigeration, refrigeration effect, work input, co-efficient of performance, Reversed carnot cycle with gas and vapour as working substance. P-V, T-S and schematic diagrams. Calculation of refrigeration effect, work C.O.P and Heat rejection. Practical difficulties with carnot cycle. with gas and vapour as working substance. Vapour compression refrigeration cycle its schematic diagram and representation on P-V, T-S and P-H diagrams. Wet, dry and superheated vapour compression. Use of tables and charts of common refrigeration for calculating work input, refrigeration effect and C.O.P deviation of actual vapour compression system form, theoretical cycle and reasons for deviation. Effect of sub-cooling and superheating on vapour compression system.

Unit 3

Basic Components of Vapour Compression Refrigeration Systems: Basic components of vapour compression refrigeration system and their function- compressor, condenser, expansion device and evaporator.
Compressor: Classification, reciprocating- open and hermetically sealed rotary, and their field of application. Working of single and double acting reciprocating compressor. Working of hermetically sealed compressor.
Condenser: Types (Water cooled, air- cooled evaporative) and their field of application and brief description.
Expansion: Types of evaporators (Dry expansion and flooded type, and principle of their working and application.

Unit 4

Vapour Absorption Refrigeration System: Comparison between vapour compression and vapour absorption system, the theoretical and practical vapour absorption system, Lithium bromide- water absorption system. Three fluid system. (Electrolux systems)

Unit 5

Properties of Commonly Used Refrigerants: Definition, primary and secondary refrigerants, designation of refrigerant, examples of each type. Desirable properties of good refrigerant Azeotropic mixtures. Environmental problems related to halogenated hydrocarbons as refrigerants. New developments.

Unit 6

Refrigeration Plants: Layout and working of Ice plant, cold storage. Water cooler and household refrigerator.

Unit 7

Refrigeration Fittings, Tools, Charging and Leak Detection: Tubing, Materials heat treatment specifications. **Tools:** Use and types of cutter, spring and mechanical bender-flaring and swaging tools pinch of tool, wrenches, Pliers etc. **Fittings:** Flared tube fittings, unions, elbows tee. **Joints:** Making soldered and brazed joints. Installation and removal of servicing gauge and testing manifold: Working of suction and discharge compressor service valves. **Charging of Refrigerant:** evacuating a refrigeration system, removing, refrigerant form a refrigeration system leak detection methods.

Unit 8

Introduction to Air Conditioning : Meaning of air conditioning, application of Air conditioning in theatres, community halls, industry, restaurants, hospitals and windows air conditioner.

Unit 9

Psychometry: psychometric - definition, terminology, psychometric charts and tables, using psychometric charts for solving simple problems.

Unit 10

Air Conditioning Systems: Central and unit air conditioning, residential and commercial air conditioning system. Types of fans and ducts - air distribution systems. Thermal insulator, methods and insulation cladding.

Unit 11

Maintenance and Repairing of Refrigeration and Air Conditioning Units: Fault location in vapour compression system and air conditions. Repair and maintenance of house hold refrigerators. Water coolers and air conditioners.

References

- 1 Refrigeration and Air Conditioning by C.P. Arora (Tata Mc Graw Hill)
- 2 Ashrae Guide and Data Book by Ashrae (Ashrae)
- 3 Andels Refrigeration and Air Conditioning Guide. by E.P. Anderson (Tarapowala)
- 4 Practical Refrigeration
- 5 Refrigeration and Air Conditioning by A.S. Sarao & P.C. Gaabi (SatyaPrakashan)
- 6 Modern Refrigeration Practice by G.P. King (McGraw Hill)
- 7 A Course in Refrigeration & Air Condition by S. Lomkkundwar & S.C. Arora (Dhanpat Rai & Sons)
- 8 Refrigeration and Air Conditioning by R.C. Jordan & S.B. Priester (Prentice Hall)

- 9 Basic Refrigeration and Air Conditioning by D. Hazre & D.N. Chakravarty (Dhanpat Rai & Sons)
- 10 Principles of Refrigeration by R. W. Marsh (Taraporwala)
- 11 Refrigeration and Air Conditioning by P.L . Ballancey. (Khanna Publishers)
- 12 Principles of Refrigeration by D.P. Gupta Rajdhani.
- 13 I.S. : 1476 - 1971 Specification for Domestic Refrigerators (Mechanically Operated) by Indian Standard Institution, Manak Bhawan, 9 Bhadur Shah Zafar Marg, New Delhi- I (I.S.I)
- 14 I.S. 1391-1960 Room Air Conditioner by Indian Standards Institution, Manak Bhawan, 9 Bhadur Shah Zafar Marg, New Delhi -1 (I.S.I)
- 15 I.S. : 1474-1959 Comm. Refrigerator . by Indian Standards Institution, Manak Bhawan, 9 Bhadur Shah Zafar Marg, New Delhi-1 (I.S.I)
- 16 I.S. : 1474-1971 Self Contained . by Indian Standards Institution, Manak Bhawan, 9 Bhadur Shah Zafar Marg, New Delhi-1 (I.S.I)
- 17 I.S. Drinking Water Coolers. by Indian Standards Institution, Manak Bhawan, 9 Bhadur Shah Zafar Marg, New Delhi-1 (I.S.I)
- 18 Refrigeration & Air Conditioning. by R.C. Patel..

List of Experiments

1. Handling and use of tools such as- Tube cutter, tube bender, (Spring and mechanical type). Flaring and Swaging tool, wrenches, pliers, service valves, service gauges, preparation of soldered and brazing joints.
2. Study of water cooler with respect to
 - (a) Refrigerant used and flow path. (b) Electric circuit
 - (c) Water flow path (d) Specification of main components used.
 - (e) Capacity of the unit.
3. Study of packaged/ Window/ Air conditioner with respect to-
 - (a) Capacity. (b) Electric circuit
 - (c) Air flow path. (d) Specification of main components used.
 - (e) Refrigerant used.
4. Study of Ice-plat/ refrigeration cold storage with respect to-
 - (a) Electric circuit (b) Refrigerant used and its flow path.
 - (c) Capacity. (d) Specification
5. Leakage detection using ;
 - (a) Soap and water. (b) Halide torch.
 - (c) Vacuum method. (d) Pressure method.
6. Operating service valves and gauge manifold.
7. Removing refrigerant from systems
8. Charging/Recharging the system refrigerator, water cooler, air conditioner
9. Determination of refrigeration capacity.Power input, C.O.P of the given unit available in the institution.
10. Testing refrigeration and air conditioning system control components for proper functioning and replacement.
 - (a) Capacitor (b) Starting and running windings of hermetically sealed compressor.
 - (c) Overload (d) Relay
 - (e) LP and HP (f) Thermostat.

Unit 1

Steam Power Plant: Energy conversion in a thermal power station. Limitations on conversion of heat into work, direct conversion devices, central power station, industrial power station, captive power station, advantages. Classification of power station on the basis of prime-movers. Elements of steam power plant function of each element- generating unit, prime mover, auxiliary equipment and turbo generator. Revision & Improvement of thermal efficiency of Rankine cycle by lowering exhaust pressure, increasing boiler pressure and superheating of steam. Simple problems on Rankine efficiency.

Reheat cycle: Representation on T-S and H-S planes, flow diagram and advantages. Simple regenerative cycle: flow diagram, representation on T-S and H-S planes, bleeding and feed water heating and pumping.

Unit 2

Steam Generators: Classification according to working pressure Accessories - Super heater, economizer, pre-heater and draft equipment, superheat control methods, pulverized fuel-necessity, storing system. High pressure boiler in modern steam power plant need, features and functions of Velox, Benson, Lamaunt, Leoffler high pressure boiler.

Unit 3

Steam Primemover: Steam nozzle-Types, velocity of steam at outlet, weight of discharge, area of cross-section at throat and outlet, critical pressure ratio, nozzle efficiency, concept of prime mover, steam turbine- Revision of steam turbine in terms of principle of working, methods of compounding and governing, losses in steam turbines, lubrication system of steam turbines.

Unit 4

Condensing Unit: Steam Condenser, functions, type-jet and surface. Limitations and advantages, elements of condensing unit-cooling towers.

Unit 5

Steam Power Station Control and Safety: Effect of load variation on shaft speed, steam admission, valve opening, steam flow rate, steam pressure and combustion control system. Necessity of controlling factors in load variation, control system (area system, centralized control system) functions of annunciator panel system, basic elements of control system, controls and instruments located in a modern central station. Control room, records and their purpose, log sheets or log book.

Unit 6

Nuclear Power Stations: Nuclear reactions - fission, fusion, mass defect, binding energy, chain reaction, types of nuclear materials - fissile materials, fertile materials, process of conversion of fertile Materials, breeding moderation.

Nuclear reactor - Function- elements of a nuclear reactor- Reacted core, moderator, thermal - Shielding reflector, reactor vessel, fuel, coolant flow, control roads, biological shielding coolants (Caseansnon-boiling liquid, boiling liquid) Fluids - Helium, Co₂ , O₂ under pressure,

pressurised water (Ordinary, heavy) liquid metals (Li, Si, Pb, Na) and their alloys,boiling water.

Operation - Fast reactors, thermal reactor, breeding reactor.

Nuclear fuel - Heterogeneous, Homogeneous.

Moderator: Water moderator, heavy water moderator, graphite moderator and Berylling moderator.

Health hazards in nuclear power station- Unit of radiation safe and dangerous zones of radiations, safety precautions in a nuclear power station- Medical requirements, Entry requirements: In contamination zones, precaution during changing of fuel. Nuclear waste disposal.

Unit 7

Diesel Power Plants: Advantages and disadvantages as a prime mover for power generation, essential components of diesel power plant and function. Cooling and lubrication system, fuel injection system- Basic requirements, fuel injection system –common rail system, individual pump system, distribution system, data recording, performance.

Unit 8

Gas Turbine Powers Plants: Advantages of gas turbines over I.C. Engine as prime movers, Brayton or Joule cycle, schematic diagrams for open and closed cycles, representation of cycle on P.V. and T.S.

diagram. Thermal efficiency in terms of terminal temperature and pressure, effect of pressure ratio on thermal efficiency, advantages and disadvantages of open and closed cycle gas turbines, important components of a gas turbine power plant, methods of improving thermal efficiency, essential auxiliaries and controls of a gas turbine power plant, fuels for gas turbines.

Unit 9

Hydro Electric Plants: Types, Comparison of low, medium and high heat plants, elements of hydro power plants, governing of turbines, performance of water turbines, site selection.

References

- 1) Course in Power Plant Engineering By S.Domkundwar.
- 2) A Course in Power Plant Engineering By T. Morse.
- 3) A Course in Power Plant Engineering By Nagpal.
- 4)A Course in Power Plant Engineering By Agrawal.

List of Experiments

1. Study of constructional and working details of :
 - (a) Simple steam power plant.
 - (b) Nuclear power plant.
 - (c) Gas power plant.
 - (d) Diesel power plant.
 - (e) Hydro electric plant.
2. Study of controls provided in power plants listed above.
3. Draw balance sheet for diesel engine.

4. Performance and characteristics of steam/ hydraulic turbines.
5. Visits of various power plants located in Madhya Pradesh and
6. submit report in terms of :
 - (a) Detailed layout
 - (b) Capacity
 - (c) Elements of each unit.
 - (d) Control systems provided.
 - (e) Berometers which are being controlled.
 - (f) Doses occuring in various units.
 - (g) Maintenance of schedule.
 - (h) Lubrication systems, uses.

1) Specification on Minor Projects : To prepare a write up or feasible report containing not more than 1500 words, using appropriate diagrams & Illustrations, and in simple language to be understood by non- technical readers, about an engineering topic.

Suggested Topics: Feasibility of non conventional sources of energy for a particular application. Solar heaters (Gobar gas Plant) Technicians role in village feasibility of certain projects.

2) Prepare a comparative study report about alternative materials available for a particular application.

Suggested Topics: Electrical conductors. Cutting tools for high speed, machining. Furniture making Cooking utensile.

3) Prepare a technical paper to be read to the rest of the class, about the process of conversion of raw material in to a finished product.

Suggested Topics: Rubber tyres. Production of mechanical engineering products. Lubricating oils

Production of plastic buckets. Production of stainless steel products. Detergents. Products involving special welding or costing processes.

4) Prepare a survey of equipment, available for a particular engineering situation, make a comparative study and suggest a suitable choice.

Suggested Topics : Material handling equipment Machine tool for given product. Measuring instruments.

5) Prepare a simple machine or component as per given drawing specification.

Suggested Jobs : A simple drilling machine model. A punching Machine. An inexpensive hardness tester.

Simple materials testing equipment.

6) Reclaiming a worn out component or equipment and putting it to use.

Suggested Job : A worn out cam shaft bearing assembly. A rejected I.C. Engine used in a motor cycle.

Re- conditioning a discarded pump.

7) Construction of simple laboratory equipment/ teaching aids.

Design and Make Type Projects:

- Suggested Projects: Lab equipment to demonstrate and verify the principle of conservation of momentum either linear angular with an accuracy of 5% A lathe tool dynamometer to measure cutting forces.

- A working model of a variable speed drive, which when given a fixed r.p.m. input, will be able to give a stepless variable output r.p.m., within the range of 3 times the input to 1/3 times the input.
- A Sheet metal cutting machine, useful to village blacksmiths in preparing articles like hand pumps, funnels, containers etc.
- A Wood working machine, hand or pedal operated to be useful in a village situation.
- Equipment to provide hot water in your hostel, using solar energy.
- suitable hand operated press for producing ornamental tiles.
- A device to utilise energy from the wind, for drawing water from a well for irrigating a small farm.
- A Design and development of hand operated grinder/juicer. Design and development of special furniture, e.g. for hospitals, handicapped persons etc.
- Material handling equipment to suit the needs of a local industry.
- Design and development of jigs / fixture for a live production situation.

Investigation Projects :

- Suggested Themes : Selection of a suitable machine tool to produce a given component with specified tolerances, economically.
- Analysing the causes and suggesting remedial steps for a machine which is functioning erratically.
- Causes of bearing failure in a given situation.
- Investigation in to the cutting forces set up on a lathe for different feeds, speeds and materials.
- Determining the most economical, running conditions for an. I.C. engine.
- Investigation in to the different methods of measurements of flow/ temperature/ pressure with a view to suggest a suitable method for a live situation.
- Installing, commissioning and fault rectification of a test/ measuring set up or a machine.

Feasibility Studies :

- Suggested Products : Packaging material. Household utensils. Furniture, Match boxes, Wire nails, Vulcanising unit. Time Piece components, plastic buckets, Aluminium anodised tiffin boxes, Raxine bags, folders etc. Washing soap, Instrument boxes for schools.

LIST OF SUGGESTED SKILLS TO ACQUIRE

1. Participate effectively in group work.
2. Analyse, synthesise and evaluate at technician level while dealing with engineering situations.
3. Apply his knowledge in practical situations.
4. Be able to plan ahead.
5. Be able to take appropriate decisions.
6. Maintain good human relations, by possessing social skills and tolerance.
7. Be able to arrive at creative solutions to problems.
8. Demonstrate self reliance and self discipline.
9. Understand and accept his own strengths and limitations

10. Adapt readily to changing environments.
11. Have a sense of purpose and pride of achievement.
12. Demonstrate his initiative.
13. Reliably work independently.
14. Be able to seek, select, use and present information's.

The following points, concerning the project should be noted :

- A record of all calculations, drawings and designs must be kept.
- Student will work either individually or in a group of 2, 3.
- A Written report must be available to the supervisor at the end of the course. This report should be neatly written and produced in a suitable folder which bears the name of the polytechnic, the title of the project and the name of the contributor and the dates of the work. Although the reports will obviously vary from project to project, yet, they should in general, conform to the following pattern :
 - (a) **Summary:** A summary of the report which should not exceed one page in length.
 - (b) **Index:** The report should be logically indexed.
 - (c) **Introduction:** This should introduce the reader to the objectives of the exercise.
 - (d) **Main body:** this will vary considerably from project to project and will contain all design calculations, drawings. Results etc.
 - (e) **Conclusion:** This will state the main conclusions of the exercise.
 - (f) **Bibliography:** A list of all references used.
- In general, you will find that a well presented brief concise and logical report will score a higher assessment than a badly presented, lengthy muddled and illogical report.

- The examiners will look for the following points when assessing your project:
 - (a) The way in which you have applied existing knowledge to your project.
 - (b) Mental skill in manipulations of formulas etc.
 - (c) The quality of physical skills in the manufacture and assembly of apparatus and test pieces etc.
 - (d) Analysis of test results to produce a conclusion.
 - (e) The ability to produce a complete project from all the individual elements.
 - (f) Skill in evaluating between, for instance, various design alternatives.
 - (g) The way in which the initial specifications are interpreted and translated in to a finished project.
 - (h) The quality of the creative aspect of the design to meet the given specifications.
 - (i) The quality of the written content of the report.
 - (j) The quality to the graphical content of the report.

1) Industrial Visits

Structured industrial visits be arranged and report of the same shall be submitted by the individual student, to form a part of the term work. (2 visits)

Following are the suggested types of Industries/ Fields -

- i) Automobile manufacturing / auto component manufacturing units to observe the working of SPM
- ii) Refrigeration and air conditioning manufacturing / servicing units / industries / workshops
- iii) Automobile service stations for four wheelers
- iv) Co-ordinate measuring machine to observe its construction working specifications and applications.
- v) Auto Engine Testing unit to gather details regarding the testing procedures/parameters etc.
- vi) Wheel Balancing unit for light and/or heavy motor vehicles.
- vii) Food processing unit.
- viii) Textile industry machinery manufacturing / servicing units.
- ix) Hydro electric and Thermal power plants.
- x) Engine testing, exhaust gas analysis and vehicle testing
- xi) PWD workshop.

2) The Guest Lecture/s

From field/industry experts, professionals to be arranged (2 Hrs duration), minimum 4 nos. from the following or alike topics. The brief report to be submitted on the guest lecture by each student as a part of

Term work:-

- | | |
|---------------------------------------|--|
| a) Electronic fuel injection systems | b) Exhaust gas analysis |
| c) Vehicle testing. | d) Transducer application in automobiles |
| e) Environmental pollution & control. | f) Vehicle aerodynamics & design. |
| g) Earth moving machines. | h) Automobile pollution, norms of pollution control. |
| i) Biotechnology | j) Nanotechnology |
| k) Rapid prototyping | l) Programmable logic controllers |
| m) TQM | n) MPFI |
| o) Hybrid motor vehicles | p) Packaging technology |
| q) Appropriate technology | r) Six sigma systems |
| s) LPG / CNG conversion kit. | |

3) Group Discussion :

The students should discuss in group of six to eight students and write a brief report on the same, as a part of term work. The topic of group discussions may be selected by the faculty members. Some of the suggested topics are (any one)-

- | | |
|-----------------------------------|--|
| i) CNG versus LPG as a fuel. | ii) Petrol versus Diesel as a fuel for cars. |
| iii) Trends in automobile market. | iv) Load shading and remedial measures. |
| v) Rain water harvesting. | vi) Trends in refrigeration Technology. |
| vii) Disaster management. | viii) Safety in day to day life. |
| ix) Energy Saving in Institute. | x) Nano technology. |

4) Seminar : (any 2 topics)

Seminar topic should be related to the subjects of fifth semester / topics from guest lectures. Students shall submit a report of at least 10 pages and deliver a seminar (Presentation time – 10 minutes for a group of 2 Students)

5) Individual Assignments: Any two from the list suggested

- a) Process sequence of any two machine components.
- b) Write material specifications for any two composite jobs.
- c) Collection of samples of different plastic material or cutting tools with properties, specifications and applications.
- d) Preparing models using development of surfaces.
- e) Assignments on bending moment, shear forces, deflection of beams and torsion chapters of strength of material.
- f) Select different materials with specifications for at least 10 different machine components and list the important material properties desirable.
- g) Select 5 different carbon steels and alloy steels used in mechanical engineering applications and specify heat treatment processes employed for improving the properties. Also give brief description of the heat treatment processes.
- h) List the various properties and applications of following materials –
 - a. Ceramics,
 - b. fiber reinforcement plastics,
 - c. thermo plastic plastics
 - d. thermo setting plastics, e. rubbers.

OR

Conduct **ANY ONE** of the following activities through active participation of students and write report

- i) Rally for energy conservation / tree plantation.
- ii) Survey for local social problems such as mal nutrition, unemployment, cleanliness, illiteracy etc.
- iii) Conduct aptitude , general knowledge test , IQ test
- iv) Arrange **any one** training in the following areas :
 - a) Yoga.
 - b) Use of fire fighting equipment and First aid Maintenance of Domestic appliances.

6) Mini Projects : (in a group of 4-5 students)

- 1) Design / drawing of simple jigs, fixtures
- 2) Thermocouple based temperature controller.
- 3) Pump on / off timer
- 4) Models of jigs / fixtures
- 5) Layout design of SSI units / factory / workshop of the institute Models of material handling route systems

OR

Modular Course on any one of the suggested or alike relevant topic be undertaken by a group of students (Min 10) :

- a) LPG/CNG conversion of vehicles
- b) Advance features in CAD –CAM
- c) basics of PLC programming
- d) die design
- e) JIT techniques
- f) Non traditional manufacturing methods
- g) jigs and fixture design
- h) 3D Modeling
- I) finite element method
- j) Mechatronics
- k) Advanced computer programming
- l) maintenance of home appliances
- m) value stream mapping
- n) piping technology

7) Student Activities – Students in a group of 3 to 4 shall perform ANY TWO of the following activities (Other similar activities may be considered) and write a report as a part of term work Activities :-

1. Collection of data regarding loan facilities or other facilities available through different organizations / banks to budding entrepreneurs
2. Survey and interviews of successful entrepreneurs in near by areas
3. Survey of opportunities available in thrust areas identified by Government or DIC.
4. Measuring Screw thread parameters on floating carriage dial micrometer and select the optimum diameter of wire.
5. Survey of data regarding different types of pumps with specifications from manufacturers catalogue, local markets, end users (any other engineering products may be considered for survey)
6. Survey of farm implements used by farmers.

LIST OF REFERENCE BOOKS

1. Nanotechnology by Mark Ratner and Daniel Ratner (Pearson Education, New Delhi)
2. Computer Control of Manufacturing System by Yoram Korem (Mcgraw Hill Publication)
3. Supply Chain Management by Sunil Chopra, Peter Meindl (Pearson Education, New)