Scheme of Teaching and Examination for

5 th Semester of 3 Years Diploma in Mechanical 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.	Power Engineering	MEC 503	Theory	3	-	-	3	100	80	20	26	40
2.	Adv. Manufacturing Technology	MEC 504	Theory	3	-	-	3	100	80	20	26	40
3.	Metrology & Quality Control	MEC 505	Theory	3	-	-	3	100	80	20	26	40
4.	Electronics Engineering	MEC 506	Theory	3	-	-	3	100	80	20	26	40
5.	Elective I	MEC 507/508/509/510	Theory	3	-	-	3	100	80	20	26	40
6.	Power Engineering Lab	MEC 511	Practical	-	-	2	4	50	40	10	-	20
7.	Adv. Manufacturing Tech. Lab	MEC 512	Practical	-	-	2	4	50	40	10	-	20
8.	Metrology & Quality Control Lab	MEC 513	Sessional	-	-	2	-	25	15	10	-	13
9.	Electronics Engineering Lab	MEC 514	Sessional	-	-	2	-	25	15	10	-	13
10.	Elective-I Lab	MEC 515/516/517/518	Sessional	-	-	2	-	50	30	20	-	25
11.	In Plant Training	502	sessional	-	-	-	-	50	30	20	-	25
12.	DLS	501	Sessional	-	-	4	-	50	30	20	-	25
Total Hours of Teaching per week :				**15**		**14**						

Elective I (Power Plant Engineering – MEC 507/ Automobile Engineering –MEC 508/ CAD/CAM & Robotics – MEC 509/ Installation & Maintenance- MEC510)

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 Cantered 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 : Power Engineering
Subject Code : MEC 503
Hours : 42
Full Marks : 80+20

NOTE:

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

CONTENTS

Sl. No.	Name of the Topic	Hours
1.	**I.C. Engine and Testing** 1.1 Power Cycles - Carnot, Otto, Diesel, Dual-combustion, representation on P-V, T-S diagram.(air standard efficiency, simple numerical) 1.2 Explain classification of I.C. engines, Identify various I.C. engine parts & their functions 1.3 Engine terminology:- Stroke, bore, piston speed, mean effective Pressure, compression & cut-off ratio etc. 1.4 Two stroke and four stroke Engines- Construction and working, comparison, valve timing Diagram, Turning moment diagram 1.5 Brief description of I.C. Engine combustion (SI & CI), scavenging, pre-ignition, detonation, supercharging, turbo charging, simple Carburetor, M.P.F.I., C.R.D.I, fuel injection Pump Latest developments in I.C. engine. 1.6 Determination of I.H.P., B.H.P. and F.H.P. & mechanical efficiency, indicated thermal efficiency, brake thermal efficiency, volumetric efficiency and specific fuel combustion, Heat balance sheet, Morse test. (simple numerical) 1.7 Types of fuel, lubricant additives and their advantages. 1.8 Pollution considerations (Euro and Bharat Stage Norms)	**12**
2.	**AIR COMPRESSER** 2.1 - Introduction - Classification of air compressors - Definition: - Pressure ratio, Compressor capacity, Free air delivered, Swept volume - Uses of compressed air - Single stage, multi stage, single acting, double acting 2.2 Reciprocating air compressor - Construction and working of single stage and two stage	**10**

	compressor - Efficiency: - Volumetric , Isothermal & Mechanical (Only simple numerical) - Advantages of multi staging. 2.3 Rotary Compressor - Construction and working of screw, lobe, vane, centrifugal compressors &Axial flow compressor (No numerical) - Comparison and applications of reciprocating and rotary compressors 2.4 Methods of energy saving in air compressors.	
3.	**Gas Turbine And Jet Propulsion** 3.1 Classification and applications of gas turbine. 3.2 Constant volume and constant pressure gas turbines. - Closed cycle and open cycle gas turbines and their comparison. 3.3 Methods to improve thermal efficiency of gas turbine- Regeneration, inter- cooling, reheating using T- S diagram (no analytical treatment) 3.4 Jet Propulsion - Principles of turbojet, turbo propeller, Ram jet. 3.5 Rocket propulsion - Solid propellants, solid propellant rocket and liquid propellants, components of liquid propellants, liquid propellant Rocket.	**10**
4.	**Refrigeration and Air- Conditioning** 4.1 Air Refrigeration cycle 4.1.1 Define Refrigeration 4.1.2 Explain methods of Refrigeration 4.1.3 State unit of Refrigeration, C.O.P. 4.1.4 Explain Carnot cycle, reversed carnot cycle, bell Coleman cycle and derive the C.O.P. with simple problems 4.1.5 Explain open air and closed air refrigeration system 4.2 Vapour compression system 4.2.1 Explain the principle and analysis of vapour comp. Refrigeration system with help of P-H, T-S diagram, simple problem 4.2.2 Write down different types of refrigerant with their properties (Ammonia, CO_2, F-11, F-12) 4.2.3 Briefly Explain the working principle of Ice-plant, cold storage, domestic Refrigerator. 4.3 Vapour absorption system Explain the working principle of vapour absorption system 4.4 Psychometric Psychometric Properties of air, Dalton's law of partial pressure psychometric chart & processes (No numerical)	**10**

	4.4 Air conditioning systems Definition of Air conditioning and classification of Air conditioning Systems.(Elementary treatment) Application- Window air conditioner.	

Subject Title : Power Engineering Lab
Subject Code : MEC 511

List of Practical:

1. Study and running of two stroke petrol and diesel engine
2. Study and running of four stroke petrol and diesel engine
3. Performance test of four stroke diesel and petrol engine.
   (i) Mechanical efficiency
   (ii) Brake thermal efficiency
   (iii) Specific fuel consumption/BHP/HR
4. Morse test on (multi cylinder) I.C. engine
5. Perform experiments on air compressor rig
6. Trial on two-stage Reciprocating compressor
7. Find the COP of refrigerator
8. Study of Ice plant
9. Study of domestic refrigerator
10. Identify the components and trace the flow of refrigerant through various components in window air conditioner.

Books Recommended

1. V. M. Domkundwar	Course in Thermal Engineering.	Dhanpat Rai & Co
2. P.L.Ballaney	Thermal Engineering.	Khanna Publishers
3. R.S.Khurmi	Text Book of Thermal Engineering.	S.Chand & Co. Ltd
4. K. K. Jain	Automobile Engineering.	Tata McGraw Hill
5. Kirpal Singh	Automobile Engg. Vol.-I , II	
6. V. Ganeshan	I.C Engines..	Tata Mc-Grawhill
7. P.K.Nag	Engineering Thermodynamics	TataMcGrawHill
8. R. K. Rajput	A Course in Thermal Engineering	Laxmi Publication, Delhi

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 : Metrology & Quality Control
Subject Code : MEC 505
Full Marks : 80+ 20
Hours : 42

Content-

Chapter	Name of the Topic	Hours
01	**Introduction to metrology** **1.1 Metrology Basics** Definition of metrology, Categories of metrology, Scientific metrology, Industrial metrology, Legal metrology, Need of inspection, **Revision of** (no questions be set) - Precision, Accuracy, Sensitivity, Readability, Calibration, Traceability, Reproducibility, Sources of errors, Factors affecting accuracy, Selection of instrument, Precautions while using an instruments for getting higher precision and accuracy. **1.2 Limits, Fits ,Tolerances and Gauges** Concept of Limits, Fits, And Tolerances, Selective Assembly, Interchangeability, Hole And Shaft Basis System, Taylor's Principle, Design of Plug, Ring Gauges, IS919-1993 (Limits, Fits & Tolerances, Gauges IS 3477-1973, concept of multi gauging and inspection. **1.3 Linear Measurement** Description, working principle, method of reading, least count for Vernier calipers, Micrometers (Outside micrometers, Inside Micrometers), Depth gauge, Height Gauge, Feeler Gauge, Slip gauges(category, use, Selection of Slip Gauges for setting particular dimension) , Length bars. **1.4 Angular Measurement** Concept, Instruments For Angular, Measurements, Working And Use of Universal Bevel Protractor, Sine Bar, Spirit Level, Principle of Working of Clinometers, Angle Gauges (With Numerical on Setting of Angle Gauges). **1.5 Standards and Comparators** Definition and introduction to line standard, end standard, Wavelength standard, . Definition, Requirement of good comparator, Classification, use of comparators, Working principle of comparators, Dial indicator, Sigma comparator, Pneumatic comparator, Electrical, Electronic, Relative advantages and disadvantages.	15

02	**Threads and Gear Metrology** **2.1 Screw thread Measurements** Types of thread, Errors in threads, Pitch errors, Measurement of different elements such as major diameter, minor diameter, effective diameter, pitch, Two wire methods, Thread gauge micrometer, Working principle of floating carriage dial micrometer. **2.2 Gear Measurement and Testing** Analytical and functional inspection, Rolling test, Measurement of tooth thickness, gear tooth vernier, Errors in gears such as backlash, run out, composite.	05
03	**Testing Techniques** **3.1 Measurement of surface finish** Primary and secondary texture, Sampling length, Lay, terminology as per IS 3073- 1967, direction of lay, Sources of lay and its significance, CLA, Ra, RMS, Rz values and their interpretation, Symbol for designating surface finish on drawing, Various techniques of qualitative analysis, **3.2 Machine tool testing** Parallelism, Straightness, Squareness, Coaxiallity, roundness, run out, alignment testing of machine tools as per IS standard procedure.	08
04	**Quality Control** **4.1) Quality :** Definitions, meaning of quality of product & services, Quality characteristics, Quality of design, Quality of conformance, Quality of performance, Concept of reliability, Cost, Quantity assurance, Cost of rework & repair, Quality & Inspection, Inspection stages. **4.2) Total Quality Management :** • Principles and concept of total quantity management. • Quality Audit: Concept of audit practices, lead assessor certification. • Six sigma: Statistical meaning, methodology of system Improvement , **4.3) ISO 9000 Series & other standards** Concept, ISO 9000 series quality standards, QS14000, Standards in general, Its evaluation & Implications, necessity of ISO certification, other Quality systems.	08

05	**Elementary Statistics & it's application in quality control** **5.1 Statistical Quality Control** – Meaning and importance of SQC, Variable and attribute Measurement. control charts – inherent and assignable sources of variation, control charts for variables – X & R charts, control charts for attributes p, 100p np, C, U - charts (simple numerical based on charts), process capability of machine, determination of statistical limits, different possibilities, Rejection area, Statistically capable and incapable processes, **5.2Acceptance Sampling –** Concept, Comparison with 100% inspection, Different types of sampling plans, with merits and demerits.	06
	Total	**42**

Subject : Metrology & Quality Control
Subject Code : MEC 513

List of Practical's:

1. Standard use of basic measuring instruments. Surface plate, v-block, sprit level, combination set, filler gauge, screw pitch gauge, radius gauge, vernier caliper, micrometer and slip gauges to measure dimension of given jobs.
2. To find unknown angle of component using sine bar and slip gauges.
3. Study and use of optical flat for flatness testing.
4. Measurement of screw thread elements by using screw thread micrometer, screw pitch gauge.
5. Study and use of dial indicator as a mechanical comparator for run out measurement, roundness comparison.
6. Measurement of gear tooth elements by using gear tooth vernier caliper and verification of gear tooth profile using profile projector.
7. Testing of machine/ machine tool for flatness, parallelism, perpendicularity by Dial indicator.
8. Draw the normal distribution curve and find standard deviation, variance, range.
9. To draw the normal distribution curve and find standard deviation, variance, range.
10. To draw and interpret the control limit for variable measurement (X – bar and R - chart)

Reference Books:

Sl. no.	Author	Title	Publisher
1	R. K. Jain	Engineering Metrology	Khanna Publisher
2	J.F.W. Galyer & C. R. Shotbolt	Metrology for engineers	ELBS
3	K. J. Hume	Engineering Metrology	Kalyani publishers
4	I.C. Gupta	A text book of Engineering. metrology	Dhanpat Rai and Sons
5	M. Adithan & R. Bahn	Metrology Lab manual	T.T.T.I.
6	M. Mahajan	Statistical Quality Control	Dhanpat Rai & Sons
7	T.T.T.I Chennai	Quality Control	Tata McGraw Hill
8	Juran U.M & Gryna	Quality planning & analysis	Tata McGraw Hill
9	National Productivity council	Inspection & Quality control	N.P.C
10	N. Logothetis	Managing for Total Quality	Prentic -Hall
11	Lauth Alwan	Statistical Process analysis	Tata McGraw Hill

Subject : Electronics Engineering
Subject Code : MEC506
Full marks : 80 + 20 = 100,
Hours : 42

Theory Content

1. **Basic Electronics** **(10 Hours)**

Semiconductor: Intrinsic , extrinsic, energy band concept, P N Junction, potential distribution across PN junction and associated terminologies.

Semiconductor Diodes: Introduction, Physical operation of p-n junction diodes, Characteristics of p-n junction diodes, Zener diode, Special types of diodes. Rectifier circuits (half-wave, full-wave, bridge and peak rectifiers), Diode clipper and clamper circuits, Light emitting diodes.

Bipolar Junction Transistors (BJTs): Simplified structure and physical operation of n-p-n and p-n-p transistors in the active region, Equivalent circuits, h parameters, Current-voltage characteristics of BJT, BJT as an amplifier and as a switch, BJT Circuits at DC, Biasing in BJT amplifier circuits CE Amplifiers, Voltage follower, Cascading of stages.

Field Effect Transistor(FET):, Fundamentals of FET Amplifier Circuits and Analysis, Introduction to MOSFET.

2. **Operational Amplifier** **(4 Hours)**

Operational Amplifier (Op-Amp): The ideal Op-Amp, Inverting and non-inverting configurations, Difference amplifier, CMRR, Application of Op-Amp (Summing amplifier, Integrator and Differentiator).

3. **Feedback Amplifiers and Oscillators:** **(4 Hours)**

General feedback structure, Properties and advantages of negative feedback, Basic principles of sinusoidal oscillators, The Barkhausen criterion, Oscillator circuits (Wien-Bridge oscillator, RC phase-shift oscillator and Crystal oscillator).

4. **Digital Electronics** **(8 Hours)**

Digital Electronic Principles: Introduction, Binary digits, Logic levels and Digital waveforms, Introduction to basic logic operation, Number system, Decimal numbers, Binary numbers, Decimal-to-Binary conversion, Simple binary arithmetic.

Logic Gates and Boolean Algebra: The inverter, The AND, OR, NAND NOR, Exclusive-OR and Exclusive-NOR gate, Boolean operations and expressions, Laws and Rules of Boolean algebra, De-Morgan's theorem, Boolean analysis of logic circuits, Standard forms of Boolean expressions, Boolean expression and truth table.

Combinational Logic and Their Functions: Basic combinational logic circuits, Implementation of combinational logic, The universal properties of NAND and NOR gates, Basic adders, Multiplexers and Demultiplexers., Elementary treatment of Latches, Basic concepts of Memory (RAMs) .

5. **Microprocessor & Peripheral chips :** **(8 hours)**

8085 and 8086 Microprocessor, block diagram, pinout diagrams, interrupt, stack, paging, modes, features, instruction set and programming, 8255, 8279 chips.

6. **Microcontroller:** **(8 hours)**

Introduction to 8 and 16 bit microcontroller, instruction sets and programming introductory concept.

Subject : Electronics Engineering Lab
Subject Code : MEC514

List of Experiments

(At least 10 experiments has to be performed by the students)

1. Familiarization of electronic components and devices (Testing of semiconductor diodes and transistors using digital multimeter)
2. Study and use of Oscilloscope, signal generator to view waveforms and measure amplitude and frequency of a given waveform.
3. V-I characteristics of semiconductor diode and determining its DC and AC resistance.
4. Studies on half-wave and full-wave rectifier circuits without and with capacitor filter; recording of the waveforms and measurement of average and rms values of the rectifier output.
5. V-I characteristic of an n-p-n or p-n-p transistor, DC biasing the transistor in common-emitter configuration and determination of its operating point (i.e., various voltages and currents).
6. CE multistage amplifier circuit frequency response.
7. Studies on Op-Amp applications (Inverting, non-inverting integrating and differentiating configurations); recording of the input-output waveforms.
8. Studies on Logic gates (Truth table verification of various gates).
9. Gain-frequency response studies of a FET and response of dc, RC and transformer coupled amplifiers.
10. Studies and experiments using MUX-DEMUX ICs.
11. Study on CMOS logic inverter.
12. 8085 simple programming
13. 8086 programming
14. 8 bit microprocessor interfacing
15. Study of microcontroller system
16. Simple programming for microcontroller.

Books:

1. Electronic Devices and Circuit Theory (Ninth Edition), Robert L. Boylestad and Louis Nashelsky, Pearson Education
2. Digital Fundamentals (Eighth Edition), Thomas L. Floyd and R.P. Jain, Pearson Education
3. Electronic Instrumentation, H.S. Kalsi, Tata McGraw-Hill Publishing Company Limited
4. Electronic Devices (Seventh Edition), Thomas L. Floyd, Pearson Education,
5. Microelectronic Circuits (Fifth Edition), Adel S. Sedra and Kenneth C. Smith, Oxford University Press, YMCA Library Building Jai Singh Road, New Delhi – 110 001.
6. Electronics Principles (7th Edition), Albert Malvino and David J. Bates, Tata McGraw-Hill Publishing Company Limited, New Delhi.
7. Linear Integrated Circuits by Gayakward
8. Microprocessor book by R K Gaonkar
9. 8086 Microprocessor by Lui & Gibbson
10. Microcontroller by Mazidi

Subject : Power Plant Engineering
Subject Code : MEC507
Hours : 42
Full Marks : 80+20=100

CONTENTS: Theory

Chapter	Name of the Topic	Hours
1.	**Introduction to power plant** • Power scenario in India and abroad • Types of power plants – Hydro, Nuclear, Thermal, Future trends in power sector. • Analysis of steam cycles- Carnot, Rankine, Reheat cycle, Regenerative cycle, Methods of reheating, Advantages and disadvantages of reheat cycle.	06
2.	**Hydro-Electric Power Plant** • Site selection for hydro-electric power plants • Classification of hydro-electric power plants • Advantages of hydro-electric power plants • Construction and operation of different components of hydro-electric power-stations	06
3.	**Steam Power Plant** • Layout of the steam power plant, general features of selection of site. • working of steam power plant • High pressure boilers – Construction and working of Sub-critical and Super-critical boilers. • Coal and ash handling system- equipments for in plant handling of coal such as belt conveyor, screw conveyor, bucket elevator, Coal crushing, Pulverized fuel handling system, Ball mill, Pulverized fuel and their advantages, Multi retort stoker, Pulverized fuel burner, Hydraulic and pneumatic ash handling, Electrostatic precipitator.	08

4.	**Gas turbine power plant** • Classification, General Layout, selection of site of Gas turbine power plants in India. • Different arrangements of plant components. • Comparison of Gas turbine plant with Steam power plant. • Environmental impact of gas turbine power plant.	**04**
5.	**Nuclear power plant** • Elements of nuclear power station, layout, general criteria for selection of site. • Fusion and fission reaction, types of nuclear reactors, Nuclear fuels, coolant & moderators. • Working of PWR, BWR, CANDU, BREEDER type reactor. • Safety precautions, nuclear waste and its disposals.	**06**
6.	**Non conventional power generation plants** • Tidal power plant- factors affecting suitability of site, working of different tidal power plants, advantages and disadvantages. • Wind power plant- different types, advantages and Disadvantages. • Solar power plant- suitability of site, different types of solar plates, advantages and disadvantages.	**04**
7.	**Waste Heat recovery** • Sources of waste heat • Heat recovery forms & methods – Sensible and latent Heat recovery. • Use of waste heat- Agricultural, green house, Animal shelter, Aqua cultural uses, process heating. • Waste Heat recovery boilers	**04**
8.	**Economics and operational aspects** • Prediction of load, selection of types of generation, number of generating units. • Load duration curves, cost analysis, elements, controlling the cost of power plant (simple numerical) • Major electrical equipments in power station- generator, step-up transformer, switch gear, (types, purpose & importance).	**04**
		42

Subject : Power Plant Engineering Lab (Elective-I)
Subject Code : MEC515

List of Practical: Power Plant Engineering

1. Study of working principles of various components of hydro-electric power plants.
2. Study of working principles of various components of steam power plants.
3. Study of working principles of various components of gas turbine power plants.
4. Study of working principles of various components of nuclear power plants.
5. Visit to steam power plants/nuclear power plants/gas turbine power plants.

   Hydro- electric powers plants and prepare a report.
6. Collect information & Technical details of Wind power plants.
7. Collect information & Technical details of solar power plants.
8. Assignment on Coal & Ash Handling system.
9. Assignment on Waste Heat recovery systems.
10. Study of economic and operational aspects of power plants (simple numerical).

Reference Books-

1.	P. K. Nag	Power plant engineering	Tata McGraw Hill
2.	Fredrick T. Mosse	Power plant engineering	East-West press
3.	A. Chkrabarti and M. L. Soni	A text book of Power System	Dhanpat Rai and Co
4.	Arora and Domkundwar	A course in power plant engineering	Dhanpat Rai and Co

Subject : Automobile Engineering
Subject Code : MEC508
Hours : 42
Full Marks : 80+20=100

CONTENTS: Theory

Chapter	Name of the Topic	Hours
1.	**1. Introduction to Automobiles.** 1.1 Introduction of Engine and its classification. Construction and working of 2 stroke and 4 stroke (petrol and diesel) & comparison. 1.2 Classification of automobile vehicles, types of automobile vehicles. ➢ Two and four wheeler chassis layout of an automobile vehicle, automobile body types ➢ Layout of vehicle such as front engine rear wheel drive, front engine front wheel drive, rear engine rear wheel drive, four wheels drive etc. their advantages, comparisons. ➢ Aero dynamic body shapes & advantages. ➢ Automobile market in India and company collaboration	**04**
2.	**2. Transmission Systems:** 2.1 Need, principle and Requirements of transmission system. Its components and their functions. 2.2 **Clutch**: Function and purpose of clutch, types and construction of clutches as plate type, Centrifugal and diaphragm type clutch. 2.3 **Gearbox**-Need, function, types- constant mesh, sliding gear, synchromeshgearboxes,Epicyclicgearboxtheirconstructionandoperation.Overdrive,transfercase,Twowheelergearboxconstructionandoperation 2.4 **Propeller shaft** types and construction, functions of universal and slip joints. 2.5 **Differential**-need,constructionandworking,differentialactionandoperation **2. Axle**–Hot chkiss and torque tube drives, Rear-full floating axle, semi floating and three quarter floating axle. Front axle.	**10**
3.	**3. Control Systems:** 3.1 **Steering System:** Purpose of steering system, steering linkage. construction and working of-re circulating ball type and rack and pinion. Wheel Geometry-caster, camber, king pin inclination, Toe In and Toe Out and their effect. Power steering 3.2 **Braking System:** Need of braking system, types of automotive braking systems for two and four wheeler vehicles– mechanical, hydraulic and air operated ➢ Hydraulic braking systems: Layout & components of hydraulic braking systems ➢ Construction and working of master cylinder and wheel cylinder. ➢ Internal and external Drum braking system, Disc Braking Systems and comparison ➢ Air braking system**:** lay out and working	08

4.	**4. Suspension Systems, Wheels and Tiers** 4.1 **Necessity and Classification of Suspension System** Front and rear suspension system construction and working of Wish bone type, Mac Pherson type, Trailing link type, coiled springs, leaf spring and shock absorbers, air suspension system. Introduction of Air bag in automobile 4.2 **Wheels and Tiers** types of wheel- spoke,disc,lightalloycast.Typesofrims.Tyres-Desirableproperties,types-redialply,crossply,tubeless.Tyrespecifications.Factorsaffectingtyrelife.Wheelalignmentandbalancing.	08
5.	**5. Electrical Systems:** 5.1 **Battery:** Automotive battery construction and operation, battery capacity, Battery ratings. 5.2 **Charging System**: Need of charging system, principal Construction and operation of charging system (Alternator). Gauges-construction & working of Fuel level gauge 5.3 **Starting System:** Need of starting system, layout, and construction of starting motor, Bendix drive, over running clutch mechanism. 5.4 **Lighting System:** Layout of lighting system of two wheeler and four wheeler, Wiring harness, cable color coding. 5.5 **Ignition System and their Components** Battery, magneto, electronic ignition system.	08
	6. Automobile performance ➢ Diagnosis of engine. ➢ Introduction of Dtsi, I3S, MPFI, ASFS, FI System ➢ Important precautions while using AC system.	04
	Total	**42**

Subject : Automobile Engineering Lab
Subject Code : MEC516

List of Practical:

1. Dismantling & assembling of a single plate dry clutch assembly.
2. Dismantling & assembling of a multi-plate clutch used in two wheelers, observe the operating linkages.
3. Dismantling & assembling of any two types of gear boxes observe gear shifting, gear ratio & compare them. Open & observe CVT.
4. Open & observe universal joints such as Hooks universal joint.
5. Dismantling & assembling the differential unit with bearing locations.
6. Dismantling & assembling of anyone type of rear axle.
7. Dismantling &assembling of the steering gear box, observe the components and steering linkages.
8. Dismantling &assembling of leaf spring.
9. Dismantle and assemble telescopic hock absorber, observe its components.
10. Observe and draw layout of hydraulic braking system. Open master cylinder, wheel cylinder, and brake drum. Observe itscomponents.
11. Observeanddrawthelayoutofhydraulicallyoperatedairassistedbrakingsystem.
12. Dismantling & study of components of battery and function of charger.
13. Study of ignition, charging and starting system.
14. Study of lighting circuits, fuses and diagnosis of faults.

Learning Resources: Books:

Sr. No.	Author	Title	Publisher
01	Kirpal Singh	Automobile Engineering Vol. I	Standard Publication
02	Anthony Schwaller	Motor automotive technology	Delmar Publisher Inc.
03	Tim Gills	Automotive service	Delmar Publisher Inc.
04	Anil Chikkara	Automobile Engineering Vol. II	Satya Prakashan New Delhi
05	Crouse/Anglin.	Automobile Mechanics	TATA McGraw–HILL
06	Harbans Singth Royat	The Automobile	S. Chand Publication
07	R.B. Gupta	Automobile Engineering	Satya Prakashan New Delhi
08	S. Srinivisan	Automotive Mechanics	TATA McGraw–HILL
09	HMSETHI	Automotive Technology	TATA McGraw–HILL

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 & leveling of a machine in the machine shop using different leveling & 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/