DIPLOMA IN MECHANICAL ENGINEERING

M-SCHEME (Full Time)

II and III year

2016 onwards

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME
Implemented from 2015 – 2016
DIPLOMA IN MECHANICAL ENGINEERING (FULL TIME)
CURRICULUM OUTLINE

THIRD SEMESTER

Subject Code	Subject	HOURS PER WEEK			
		Theory	Tutorial / Drawing	Practical	Total
M-531	Strength of Materials	6	-	-	6
M-532	Manufacturing Processes	6	-	-	6
M-533	Fluid mechanics and Fluid power	6	-	-	6
M-534	Machine Drawing	-	4	-	4
M-535	Strength of materials and Fluid mechanics Practical	-	-	4	4
M-536	Foundry and Welding Practical	-	-	4	4
M-537	Metrology and Metallography Practical	-	-	4	4
	Seminar	1	-	-	1
	TOTAL	**19**	**4**	**12**	**35**

FOURTH SEMESTER

Subject Code	Subject	HOURS PER WEEK			
		Theory	Tutorial/ Drawing	Practical	Total
M-541	Heat Power Engineering	6	-	-	6
M-542	Special Machines	5	-	-	5
M-543	Electrical Drives & Control	6	-	-	6
M-544	Computer Application & CAD Practical		-	5	5
M-545	Lathe and Drilling Practical	-	-	4	4
M-546	Special Machines Practical	-	-	4	4
M-547	Electrical Drives & Control Practical	-	-	4	4
	Seminar	1	-	-	1
	TOTAL	**18**	**-**	**17**	**35**

FIFTH SEMESTER

Subject Code	Subject	HOURS PER WEEK			
		Theory	Tutorial/ Drawing	Practical	Total
M-551	Design of Machine Elements	6	-	-	6
M-552	Thermal Engineering	6	-	-	6
M-553	Process Planning and Cost Estimation	5	-	-	5
Elective - I Theory					
M-5541	Renewable Energy Sources & Energy Conservation	5	-	-	5
M-5542	Total Quality Management				
M-5543	Press Tools				
M-555	Process Automation Practical	-	-	4	4
M-556	Thermal Engineering Practical	-	-	4	4
M-557	Life and Employability Skills Practical *	-	-	4	4
	Seminar	1			1
TOTAL		**23**	**-**	**12**	**35**

* → Common to all branches

SIXTH SEMESTER

Subject Code	Subject	HOURS PER WEEK			
		Theory	Tutorial/ Drawing	Practical	Total
M-561	Industrial Engineering and Management	6	-	-	6
M-562	Computer Aided Design and Manufacturing	5	-	-	5
Elective - II Theory					
M-5631	Automobile Engineering	5	--	-	5
M-5632	Robotics				
M-5633	Refrigeration and Air-conditioning				
M-564	Computer Aided Design and Manufacturing Practical	-	-	6	6
M-565	Machine Tool Testing & Maintenance Practical			4	4
Elective - II Practical					
M-5661	Automobile Engineering Practical	-	-	4	4
M-5662	Robotics Practical				
M-5663	Refrigeration and Air-conditioning Practical				

M-567	Project Work	-	-	4	4
	Seminar	1	-	-	1
	TOTAL	**17**	**-**	**18**	**35**

SCHEME OF EXAMINATION
MECHANICAL   ENGINEERING

THIRD SEMESTER

Subject Code	SUBJECT	End Examination Marks				
		Internal Marks	End Examinations	Total Marks	Minimum for Pass	Duration of Exam Hours
M-531	Strength of Materials	25	75	100	40	3
M-532	Manufacturing Processes	25	75	100	40	3
M-533	Fluid mechanics and Fluid power	25	75	100	40	3
M-534	Machine Drawing	25	75	100	40	3
M-535	Strength of materials and Fluid mechanics Practical	25	75	100	50	3
M-536	Foundry and Welding Practical	25	75	100	50	3
M-537	Metrology and Metallography Practical	25	75	100	50	3
Total		175	525	700		

FOURTH SEMESTER

Subject Code	SUBJECT	End Examination Marks				
		Internal Marks	End Examinations	Total Marks	Minimum for Pass	Duration of Exam Hours
M-541	Heat Power Engineering	25	75	100	40	3
M-542	Special Machines	25	75	100	40	3
M-543	Electrical Drives & Control	25	75	100	40	3
M-544	Computer Application & CAD Practical	25	75	100	50	3
M-545	Lathe and Drilling Practical	25	75	100	50	3
M-546	Special Machines Practical	25	75	100	50	3
M-547	Electrical Drives & Control Practical	25	75	100	50	3
Total		175	525	700		

FIFTH SEMESTER

Subject Code	SUBJECT	End Examination Marks				
		Internal Marks	End Examinations	Total Marks	Minimum for Pass	Duration of Exam Hours
M-551	Design of Machine Elements	25	75	100	40	3
M-552	Thermal Engineering	25	75	100	40	3
M-553	Process Planning and Cost Estimation	25	75	100	40	3
M-554X	Elective - I Theory	25	75	100	40	3
M-555	Process Automation Practical	25	75	100	50	3
M-556	Thermal Engineering Practical	25	75	100	50	3
M-557	Life and Employability Skills Practical	25	75	100	50	3
Total		175	525	700		

SIXTH SEMESTER

Subject Code	SUBJECT	End Examination Marks				
		Internal Marks	End Examinations	Total Marks	Minimum for Pass	Duration of Exam Hours
M-561	Industrial Engineering and Management	25	75	100	40	3
M-562	Computer Aided Design and Manufacturing	25	75	100	40	3
M-563X	Elective- II Theory	25	75	100	40	3
M-564	Computer Aided Design and Manufacturing Practical	25	75	100	50	3
M-565	Machine Tool Testing & Maintenance Practical	25	75	100	50	3
M-566X	Elective- II Practical	25	75	100	50	3
M-567	Project Work	25	75	100	50	3
Total		175	525	700		

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name	:	**DIPLOMA IN MECHANICAL ENGINEERING**
Course Code	:	
Subject Code	:	M-531
Semester	:	III
Subject Title	:	**STRENGTH OF MATERIALS**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	Instructions		Examination				
	Hours / Week	**Hours / Semester**	**Marks**				**Duration**
Strength of Materials	6	90	**Internal Assessment**	**Board Examination**	**Total**		3 Hrs
			25	75	100		

Topics and Allocation of Hours:

Unit No	Topics	Hours
I	STATICS OF PARTICLE AND FRICTION	17
II	MECHANICAL PROPERTIES, SIMPLE STRESSES AND STRAINS	17
III	GEOMETRICAL PROPERTIES OF SECTIONS AND THIN SHELLS	17
IV	SHEAR FORCE AND BENDING MOMENT DIAGRAMS, THEORY OF SIMPLE BENDING	16
V	TORSION AND SPRINGS	16
	TEST AND REVISION	7
	Total	**90**

RATIONALE:

Day by day, engineering and technology experience tremendous growth. Design plays a major role in developing engineering and technology. Strength of material is backbone for design. The strength of material deals generally with the behaviour of objects, when they are subject to actions of forces. Evaluations derived from these basic fields provide the tools for investigation of mechanical structure.

OBJECTIVES

✦ Define various Support reaction and equilibrium.

✦ Calculate the deformation of materials, which are subjected to axial load and shear.

✦ Determine the moment of Inertia of various sections used in industries.

✦ Estimate the stresses induced in thin shells.

✦ Draw the shear force and bending moment diagram of the beam for different loads.

I   STATICS OF PARTICLES: 17

Introduction – Force - effects of a force - system of forces - resultant of force - Principle of transmissibility - parallelogram law of forces - triangular law - resultant of several forces acting on a particle - polygon law - resolution of a force into rectangular components – resultant of a system of forces acting on a particle using rectangular components - equilibrium of particles.

External and internal forces - moment of a force - Varignon's theorem - moment of a couple - equivalent couples - addition of couples - resolution of a force into a force and a couple - Free body diagram - Necessary and sufficient conditions for the equilibrium of rigid bodies in two dimension - Support reaction - types of support - removal of two dimensional supports - Simple problems only.

FRICTION:

Introduction - Definition - Force of friction - Limiting friction – Static friction - Dynamic friction - Angle of friction - co-efficient of friction - Laws of static and dynamic friction.

II   DEFORMATION OF METALS   17

Mechanical properties of materials: Engineering materials – Ferrous and non-ferrous materials - Definition of mechanical properties - Alloying elements-effect of alloying element - Fatigue, fatigue strength, creep – temperature creep – cyclic loading and repeated loading – endurance limit.

Simple stresses and strains: Definition – Load, stress and strain – Classification of force systems – tensile, compressive and shear force systems – Behaviour of mild steel in tension up to

rupture – Stress – Strain diagram – limit of proportionality – elastic limit – yield stress – breaking stress – Ultimate stress – percentage of elongation and percentage reduction in area – Hooke's law – Definition – Young's modulus - working stress, factor of safety, load factor, shear stress and shear strain - modulus of rigidity. Linear strain – Deformation due to tension and compressive force – Simple problems in tension, compression and shear force.

Definition – Lateral strain – Poisson's ratio – volumetric strain – bulk modulus – volumetric strain of rectangular and circular bars – problems connecting linear, lateral and volumetric deformation – Elastic constants and their relationship - Problems on elastic constants - Definition – Composite bar – Problem in composite bars subjected to tension and compression – Temperature stresses and strains – Simple problems – Definition – strain energy – proof resilience – modulus of resilience – The expression for strain energy stored in a bar due to Axial load – Instantaneous stresses due to gradual, sudden, impact and shock loads – Problems computing instantaneous stress and deformation in gradual, sudden, impact and shock loadings.

III   GEOMETRICAL PROPERTIES OF SECTIONS AND THIN SHELLS   17

Properties of sections: Definition – center of gravity and centroid - position of centroids of plane geometrical figures such as rectangle, triangle, circle and trapezium-problems to determine the centroid of angle, channel, T and I sections only - Definition-centroidal axis-Axis of symmetry. Moment of Inertia – Statement of parallel axis theorem and perpendicular axis theorem. Moment of Inertia of lamina of rectangle, circle, triangle, I and channel sections-Definition-Polar moment of Inertia-radius of gyration – Problems computing moment of inertia and radius of gyration for angle, T, Channel and I sections.

Thin Shells: Definition – Thin and thick cylindrical shell – Failure of thin cylindrical shell subjected to internal pressure – Derivation of Hoop and longitudinal stress causes in a thin cylindrical shell subjected to internal pressure – simple problems – change in dimensions of a thin cylindrical shell subjected to internal pressure – problems – Derivation of tensile stress induced in a thin spherical shell subjected to internal pressure – simple problems – change in diameter and volume of a thin spherical shell due to internal pressure – problems.

IV   SF AND BM DIAGRAMS OF BEAMS AND THEORY OF BENDING   16

Classification of beams – Definition – shear force and Bending moment – sign conventions for shear force and bending moment – types of loadings – Relationship between load, force and bending moment at a section – shear force diagram and bending moment diagram of cantilever and simply supported beam subjected to point load and uniformly distributed load (udl) – Determination of Maximum bending moment in cantilever beam and simply supported beam when they are subjected to point load and uniformly distributed load.

Theory of simple bending – Assumptions – Neutral axis – bending stress distribution – moment of resistance – bending equation – $M/I = f/y = E/R$ – Definition – section modulus - rectangular and circular sections – strength of beam – simple problems involving flexural formula for cantilever and simple supported beam.

V   THEORY OF TORSION AND SPRINGS   16

Theory of torsion – Assumptions – torsion equation $\frac{T}{J} = \frac{f_s}{R} = \frac{C\theta}{l}$ – strength of solid and hollow shafts – power transmitted – Definition – Polar modulus – Torsional rigidity – strength and stiffness of shafts – comparison of hollow and solid shafts in weight and strength considerations – Advantages of hollow shafts over solid shafts – Problems.

Types of springs – Laminated and coiled springs and applications – Types of coiled springs – Difference between open and closely coiled helical springs – closely coiled helical spring subjected to an axial load – problems to determine shear stress, deflection, stiffness and resilience of closed coiled helical springs

Text Books:
Strength of Materials, R. S. Khurmi, S.Chand & Co., Ram Nagar, New Delhi.
Strength of Materials, S. Ramamrutham, 15thEdn 2004, DhanpatRai Pub. Co., New Delhi.

Reference Books:
Strength of Materials, R.K. Bansal,, Laxmi Publications Pvt. Ltd., New Delhi, 3rd Edition, 2010.
Strength of materials, S.S.Rattan, Tata Mcgraw hill, New Delhi,2008, ISBN 9780070668959,
Strength of Materials, B K Sarkar, I Edition, 2003 Tata Mcgraw hill, New Delhi.
Engineering mechanics, R.K. Bansal, Laxmi Publications Pvt. Ltd., New Delhi, 2nd Edition, 2007

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name   :   DIPLOMA IN MECHANICAL ENGINEERING

Course Code   :

Subject Code   :   M-532

Semester   :   III

Subject Title   :   **MANUFACTURING PROCESSES**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination				
	Hours / Week	**Hours / Semester**	**Marks**			**Duration**
Manufacturing Processes	6	90	**Internal Assessment**	**Board Examination**	**Total**	3 Hrs
			25	75	100	

Topics and Allocation of Hours:

Unit No	Topics	Hours
I	FOUNDRY TECHNOLOGY	17
II	WELDING TECHNOLOGY	17
III	FORMING TECHNOLOGY	17
IV	THEORY OF METAL CUTTING & LATHE	16
V	DRILLING & METROLOGY	16
	TEST AND REVISION	7
	TOTAL	**90**

RATIONALE:

Manufacturing, the major and the most important aspect in industries needs utmost care and attention. Knowledge about various processes and allied areas will be of great use to the personnel involved in production. This will provide the students an opportunity to skill themselves for the industrial scenario.

OBJCETIVES
- Acquire Knowledge about types of pattern, casting, and moulding.
- Describe the various casting processes.
- Knowledge about various welding process and its working principle.
- Appreciate the safety practices used in welding.
- Acquire knowledge about various forming technologies.
- Knowledge about the lathe and its working parts.
- Describe the functioning of semi-automatic lathes.
- Study about the drilling process.
- Study about metrology and measuring instruments.

MANUFACTURING PROCESSES

DETAILED SYLLABUS
Contents: Theory

I Foundry Technology   17
Patterns: Definition–types of pattern–solid piece–split piece -loose piece – match plate - sweep - skeleton – segmental – shell – pattern materials – pattern allowances.

Moulding: Moulding sand–constituents–types–properties ofmoulding sand – moulding sand preparation – moulding tools - moulding boxes – types of moulds – green sand mould – dry sand mould – loam mould – methods of moulding – moulding machines – jolting – squeezing – sand slinger construction and working principle.

Cores: Essential qualities of core–materials–core sandpreparation – core binders – core boxes - CO_2 process core making – types of core.

Metallurgy :–Introduction - Iron-carbon diagram.

Melting furnaces: Blast furnace–Cupola furnace–cruciblefurnace – types – pit furnace – coke fired – oil fired – electric furnace – types – direct arc – indirect arc – induction furnace – working principles.

Casting: Shell mould casting–investment casting–pressure diecasting – hot chamber die casting – cold chamber die casting – gravity die casting – centrifugal casting – continuous casting - defects in casting – causes and remedies.

II Welding Technology   17
Arc Welding: Definition–arc welding equipment–electrodetypes – filler and flux materials - arc welding methods – metal arc - Metal Inert gas (MIG) - Tungsten inert gas (TIG) - Submerged arc - Electro slag welding – resistance welding – spot welding – butt welding – seam welding – Plasma arc welding – Thermit welding – Electron beam welding – Laser beam welding – friction welding – ultrasonic welding – Induction welding - working principle – applications – advantages and disadvantages.

Gas welding: Oxy-acetylene welding–advantages - limitations -gas welding equipment - Three types of flames – welding techniques – filler rods. – Flame cutting – soldering – brazing – difference between soldering and brazing.

Types of welded joints – merits and demerits of welded joints – inspection and testing of welded joints – destructive and non-destructive types of tests – magnetic particle test – radiographic and ultrasonic test - defects in welding – causes and remedies.

III   Forming Technology   17
Forging: Hot working, cold working–advantages of hot working and cold working– hot working operations – rolling, forging, smith forging, drop forging, upset forging, press forging – roll forging.

Press Working: Types of presses - mechanical and hydraulic presses - press tools and accessories - press working operations - bending operations - angle bending - channel bending – curling – drawing - shearing operations - blanking, piercing, trimming – notching – lancing.

Powder Metallurgy: Methods of manufacturing metal powders–atomization, reduction and electrolysis deposition – compacting – sintering – sizing – infiltration – mechanical properties of parts   made   by powder metallurgy – design rules for the power metallurgy process.

IV Theory of metal cutting and Lathes: 16
Theory of metal cutting: Introduction–orthogonal cutting– oblique cutting - single point cutting tool – nomenclature – types of chips – chip breakers – cutting tool materials – properties – tool wears – factors affecting tool life – cutting fluids – functions – properties of cutting fluid.

Centre Lathe: Introduction - specifications–simple sketch– principal parts – head stock – back geared type – all geared type – feed mechanism - tumbler gear mechanism – quick change gear box – apron mechanism – work holding device – three jaw chuck – four jaw chuck – centres -

faceplate – mandrel – steady rest – follower rest – machining operations done on lathe – straight turning – step turning - taper turning methods: form tool – tailstock set over method – compound rest method – taper turning attachment – knurling - Thread cutting – Facing – Boring – chamfering –grooving – parting-off – eccentric turning – cutting speed – feed - depth of cut - metal removal rate.

Semi-Automatic Lathes: Types of semi-automatic lathes– capstan and turret lathes – Geneva indexing mechanism – bar feeding mechanism - difference between turret and capstan – work holding devices – tool holders.

V Drilling and Metrology   16
Drilling Machines: Drills - flat drills - twist drills–nomenclature of twist drill - types of drilling machines - bench type - floor type - radial type - gang drill – multi spindle type -principle of operation   in drilling - methods of holding drill bit - drill chucks - socket and sleeve –drilling operation – reaming - counter sinking – counter boring - spot facing – tapping - deep hole drilling.
Metrology: Definition–need of inspection–precision–accuracy – sensitivity - magnification – repeatability – calibration – comparator – Advantages – requirements – mechanical comparator – optical comparator – electrical comparator – pneumatic comparator – Principles – advantages and disadvantages.

Measuring instruments: Construction and principles only - Steelrule – Callipers: outside calliper – inside calliper – jenny calliper – Combination set – Feeler gauge – Pitch screw gauge – Vernier calliper – Digital calliper – Vernier height gauge – Micrometer – Inside micrometer – Thread micrometer – Slip gauges – requirement – Indian standard – care and use - Sine bar – types – uses – limitations – Working principle of clinometers, autocollimator, angle dekkor.

Text Books:
1. Elements of workshop Technology Volume I & II – Hajra Chowdry & Bhattacharaya - IIth Edition - Media Promoters & Publishers Pvt. Ltd., Seewai Building `B', 20-G, Noshir Bharucha Marg, Mumbai 400 007 – 2007.
2. Introduction of basic manufacturing processes and workshop technology – Rajendersingh – New age International (P) Ltd. Publishers, 4835/24, Ansari Road, Daryaganj, New Delhi - 110002

Reference Books:
1. Manufacturing process – Begeman - 5th Edition -McGraw Hill, New Delhi 1981.
2. Workshop Technology- WAJ Chapman - Volume I, II, & III – Vima Books Pvt. Ltd., 4262/3, Ansari Road, Daryaganj, New Delhi 110 002.
3. Workshop Technology – Raghuwanshi - Khanna Publishers. Jain & Gupta,
4. Production Technology, Edn. XII, Khanna Publishers, 2-B, North Market, NAI Sarak, New Delhi 110 006 - 2006
5. Production Technology - P. C. SHARMA - Edn. X - S.Chand & Co. Ltd., Ram Nagar, New Delhi 110 055 - 2006

6. Production Technology – HMT - Edn. 18 - published by Tata McGraw Hill publishing Co. Ltd., 7 West Patel nagar, New Delhi 110 008. – 2001.

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name   :   DIPLOMA IN MECHANICAL ENGINEERING

Course Code   :

Subject Code   :   M-533

Semester   :   III

Subject Title   :   **FLUID MECHANICS & FLUID POWER**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination				
	Hours / Week	Hours / Semester	Marks				Duration
FLUID MECHANICS & FLUID POWER			Internal Assessment	Board Examination	Total		
	5	75	25	75	100		3 Hrs

Topics and Allocation of Hours:

Unit No	Topics	Hours
I	PROPERTIESOF FLUIDS ANDPRESSUREMEASUREMENTS	14
II	FLOW OF FLUIDS AND FLOW THROUGH PIPES	14
III	IMPACT OFJETS, HYDRAULICTURBINES, CENTRIFUGAL AND RECIPROCATING PUMPS	14
IV	PNEUMATIC SYSTEMS	13
V	HYDRAULIC SYSTEMS	13
	TEST AND REVISION	7
	TOTAL	**75**

RATIONALE:

The main objective of this subject Fluid mechanics and Fluid power is to study the behavior of fluids under the condition of rest and motion. This chapter deals with fluid pumps, turbines, hydraulic and pneumatic operation. The overall object is to impart knowledge of pumps, hydraulic and pneumatic operation of tools and equipments.

OBJCETIVES
- Define the properties of Fluids.
- Explain the working of pressure measuring devices
- Explain continuity equation and Bernoulli's Theorem
- Assess the impact of frictional loss of head in flow through pipes
- Estimate the discharge through orifices
- Distinguish the working principles of pumps and turbines.
- Explain the working of centrifugal pumps and reciprocating pumps.
- Compare pneumatic system with hydraulic system
- Draw Pneumatic circuits for industrial application.
- State the properties of hydraulic Systems
- Develop hydraulic circuit for machine tools applications.

DETAILED SYLLABUS

UNIT I (14)
PROPERTIES OF FLUIDS AND PRESSURE MEASUREMENTS
Introduction - Definition of fluid - Classification of Fluids - ideal and real fluids -Properties of a fluid – definition and units - Pressure-units of Pressure - Pressure head-atmospheric, gauge and absolute
pressure – problems - Pascal's law- proof - applications of Pascal's law - Hydraulic press - Hydraulic jack - Pressure measurement   -

Piezometer tube - Simple U-tube manometer - Differential U-tube manometer - Inverted Differential manometer - Micro-manometer - Inclined tube micro-manometer - Mechanical Gauges -Bourdon's Tube Pressure Gauge - Diaphragm pressure gauge - Dead weight pressure gauge.

UNIT II (14)
FLOW OF FLUIDS AND FLOW THROUGH PIPES
Types of fluid flow - path line and stream line - mean velocity of flow - discharge of a flowing fluid - equation of continuity of fluid flow - energies of fluid - Bernoulli's theorem - statement, assumptions and proof - applications and limitations of Bernoulli's theorem - problems on Bernoulli's theorem – venturimeter - derivation for discharge - orifice meter - derivation for discharge - difference between venturimeter and orifice meter -problems on venturimeter and orifice meter - Pitot tube – description only – orifice –types – applications - hydraulic co-efficient - determining hydraulic c o-efficient – problems - discharge through a small orifice

discharging freely only - problems – experimental method of finding Cv, Cc and Cd - Flow through pipes - laws of fluid friction - hydraulic gradient line - total energy line - wetted perimeter - hydraulic mean radius - loss of head due to friction – Darcy - Weisbach equation and Chezy's formula –problems - minor losses (description only) - Power transmission through pipes - problems.

UNIT III (14)
IMPACT OF JETS, HYDRAULIC TURBINES, CENTRIFUGAL   AND RECIPROCATING PUMPS

Impact of jet - on a stationary flat plate held normal to the jet and inclined to the direction of jet - Impact of jet on a flat plate moving in the direction of jet - Impact of jet on a series of moving plates or vanes - force exerted and work done by the jet - problems. Hydraulic turbines – classifications - Pelton wheel - components and working - speed regulation (theory only) - Francis and Kaplan turbines - components and working - draft tube - functions and types - surge tank - differences between impulse and reaction turbines.

Centrifugal Pumps – classifications - construction and working of single stage centrifugal pumps - components with types - theory only - multi stage pumps – advantages - priming – cavitation.

Reciprocating Pumps – classifications - construction and working of single acting and double acting reciprocating pumps - plunger and piston pumps- discharge of a reciprocating pump - theoretical power
required - coefficient of discharge – slip – problems - negative slip - indicator diagram – separation - air vessel (functions and working) -   Special pumps - Jet pump - Turbine pump - Submersible pump.

UNIT IV (13)
PNEUMATIC SYSTEMS

Pneumatic Systems – elements – filter – regulator - lubricator unit - pressure control valves - pressure relief valves - pressure regulation valves - directional control valves - 3/2 DCV - 5/2 DCV – 5/3 DCV flow control valves – throttle valves –shuttle valves – quick exhaust valves – ISO symbols of pneumatic components – pneumatic circuits – direct control of single acting cylinder – operation of double acting cylinder – operation of double acting cylinder with metering-in control – operation of double acting cylinder with metering-out control – use of shuttle valve in pneumatic circuits – use of quick exhaust valve in pneumatic circuits - automatic operation of double acting cylinder single cycle – multiple cycle – merits and demerits of pneumatic system - applications.

UNIT V (13)
HYDRAULIC SYSTEMS

Hydraulic system – Merits and demerits – Service properties of hydraulic fluids Hydraulic accumulators – Weight of gravity type accumulator – Spring loaded type accumulator - Gas filled accumulator – Pressure intensifier – Fluid power pumps – External and internal gear pump, Vane pump, Radial piston pump – ISO symbols for hydraulic components – Hydraulic

actuators – Cylinders and motors – Valves – Pressure control valves, Flow control valves and direction control valves – types – including 4/2 DCV and 4/3 DCV – their location in the circuit.

Hydraulic operation of double acting cylinder with metering-in and metering-out control – application of hydraulic circuits – Hydraulic circuit for - shaping machine - table movement in surface grinding machine and milling machine – comparison of hydraulic and pneumatic systems.

Text Books :
1. A Text Book of Hydraulics, Fluid Mechanics and Hydraulic Machines, R.S. Khurmi, - Edn.18, S.Chand & Co., Ram Nagar, New Delhi – 110 055, Ram Nagar, New Delhi
2. A Text Book of Fluid Mechanics and Hydraulic Machines – by, R. K Rajput and S.Chand & Co,Ram Nagar, New Delhi – 110 055.

Reference Books:
1. Hydraulic Machines, Jagadishlal, , Metropolitan Book Co. Pvt. Ltd., 1, Faiz Bazaar, New Delhi – 110 006.
2. Hydraulics,Andrew Parr (A Technician's and Engineer's Guide)
3. Fundamentals of pneumatic control Engineering -FESTO Manual
4. Fluid Mechanics and Hydraulic Machines,R. K. Bansal, Laxmi Publications Pvt.,Ltd,22,Golden House, Daryaganj, New Delhi – 110 002

(Implements from the Academic year 2015-2016 onwards)

Course Name	:	DIPLOMA IN MECHANICAL ENGINEERING
Course Code	:	
Subject Code	:	M-534
Semester	:	III
Subject Title	:	MACHINE DRAWING

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination				
MACHINE DRAWING	**Hours / Week**	**Hours / Semester**	**Marks**				**Duration**
	4	60	**Internal Assessment**	**Board Examination**	**Total**		3 Hrs
			25	75	100		

Topics and Allocation of Hours:

Unit No	Topics	Hours
I	SECTIONAL VIEWS	5
II	LIMITS, FITS AND TOLERANCES	5
III	SURFACE TEXTURE	5
IV	KEYS, SCREW THREADS AND THREADED FASTENERS	5
V	ASSEMBLE DRAWING	33
	TEST AND REVISION	7
	TOTAL	**60**

RATIONALE:

Manufacturing of various parts start from the basic drawing of components. The assembly of components is also carried out from the drawing. So drawing is an important subject to be studied by the students to carry and complete the production and assembly process successfully.

OBJCETIVES

- Appreciate the need for sectional view and types of sections.
- Draw sectional views using different types of sections.
- Explain the use of threaded fasteners and the types of threads.
- Compare hole basis system with shaft basis system.
- Select different types of fits and tolerance for various types of mating parts.
- Appreciate the importance of fits and tolerance.

DETAILED SYLLABUS

UNIT I (5)
SECTIONAL VIEWS
Review of sectioning – Conventions showing the section – symbolic representation of cutting plane- types of section – full section, half section, offset section, revolved section, broken section, removed
section – section lining.

UNIT II (5)
LIMITS, FITS AND TOLERANCES
Tolerances – Allowances – Unilateral and Bilateral tolerances. Limits – Methods of tolerances – Indication of tolerances on linear dimension of drawings – Geometrical tolerances – application – Fits – Classifications of fits – Selection of fits – examples

UNIT III (5)
SURFACE TEXTURE
Surface texture – importance – controlled and uncontrolled surfaces – Roughness – Waviness – lay – Machining symbols

UNIT IV (5)
KEYS, SCREW THREADS AND THREADED FASTENERS
Types of fasteners – temporary fasteners – keys – classification of keys – Heavy duty keys – light duty keys. Screw thread – Nomenclature – different types of thread profiles – threads in sections – threaded fasteners – bolts – nuts – through bolt – tap bolt, stud bolt – set screw – cap screws – machine screws – foundation bolts

UNIT V (33)
MANUAL DRAWING PRACTICE
Detailed drawings of following machine parts are given to students to assemble and draw the Elevations / Sectional elevations / Plan / and Side views with dimensioning and bill of materials
- Sleeve & Cotter joint
- Knuckle joint
- Screw Jack

- Foot step bearing
- Plummer Block
- Universal Coupling
- Simple Eccentric
- Machine Vice
- Protected type flanged coupling
- Swivel bearing.

Reference Books:
1. Machine Drawing, P.S. Gill, Katsan Publishing House, Ludiana
2. A Text book of Engineering Drawing, R.B. Gupta, Satya Prakasan, Technical India Publications, New Delhi
3. Mechanical Draughtsmanship, G.L. Tamta, Dhanpat Rai & Sons, Delhi
4. Geometrical and Machine Drawing, N.D. Bhatt, Cheroter book stalls, Anand, West Railway
5. Engineering Drawing, D.N. Ghose, Dhanpat Rai & Sons, Delhi

END EXAMINATIONS
Question Pattern

Time: 3 Hrs   Max Marks : 75

Note: All the questions will be answered in drawing sheet only

<div align="center">PART A   (7 x 5 = 35)</div>

Theory questions : (1 TO 8)
Two questions from each unit (I to IV) will be asked.
Answer any seven questions from the given eight questions.

<div align="center">PART B   40 Marks (Either A or B.)</div>

Answer any one question by selecting either A or B.
9. A. Assemble and Draw any two views and bill of materials.
<div align="center">(OR)</div>
B. Assemble and Draw any two views and bill of material

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name	:	DIPLOMA IN MECHANICAL ENGINEERING
Course Code	:	
Subject Code	:	M-535
Semester	:	III
Subject Title	:	**STRENGTH OF MATERIALS AND FLUID MECHANICS PRACTICAL**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination				
STRENGTH OF MATERIALS AND FLUID MECHANICS PRACTICAL	Hours / Week	Hours / Semester	Marks				Duration
	4	60	Internal Assessment	Board Examination	Total		3 Hrs
			25	75	100		

OBJCETIVES
- Acquire skills on different types of testing methods of metals.
- Conduct material testing on elasticity, hardness, shear strength
- Determine modulus of rigidity of open spring and closed coil springs.
- Determine the co-efficient of discharge of venturimeter, orifice meter, mouth piece and orifice.
- Determine the co-efficient of friction in pipes.
- Conduct performance test on centrifugal and reciprocating pumps.
- Conduct performance test on impulse and reaction turbines.

Strength of Materials Laboratory Exercises
1.Test on Ductile Materials:
Finding Young's Modulus of Elasticity, yield points, percentage elongation and percentage reduction in area, stress strain diagram plotting, tests on mild steel.

2. Hardness Test:
Determination of Rockwell's Hardness Number for various materials like mild steel, high carbon steel, brass, copper and aluminium.

3. Torsion test:
Torsion test on mild steel – relation between torque and angle of twist-determination of shear modulus and shear stress.

4. Impact test:
Finding the resistance of materials to impact loads by Izod test and Charpy test.

5. Tests on springs of circular section:
Determination of modulus of rigidity, strain energy, shear stress and stiffness by load deflection method (Open / Closed coil spring)

6. Shear test:
Single or double shear test on M.S. bar to finding the resistance of material to shear load.

Fluid Mechanics Laboratory Exercises
1. Verify the Bernoulli's Theorem.
2. Determination of co-efficient of discharge of a mouth piece / orifice by variable head method.
3. Determination of co-efficient of discharge of a venturimeter / orificemeter.
4. Determination of the friction factor in a pipe.
5. Performance test on reciprocating pump / centrifugal pump and to draw the characteristics curves.
6. Performance test on impulse turbine / reaction turbine and to find out the Efficiency

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name	:	DIPLOMA IN MECHANICAL ENGINEERING
Course Code	:	
Subject Code	:	M-536
Semester	:	III
Subject Title	:	**FOUNDRY AND WELDING PRACTICAL**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination			
FOUNDRY AND WELDING PRACTICAL	Hours / Week	Hours / Semester	Marks			Duration
	4	60	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

OBJCETIVES

- Identify the tools used in foundry.
- Identify the tools and equipment used in welding
- Prepare sand moulds for different patterns.
- Perform welding operation to make different types of joints.
- Identify the different welding defects.
- Appreciate the safety practices used in welding.
- Prepare a record of work for all the exercises

Foundry Section
1. Introduction of tools and equipment
2. Types of patterns
3. Types of sand
4. Preparation of sand moulds
5. Core sands, preparation of cores

Exercises:
Prepare the green sand mould using the following patterns.
1. Solid pattern
2. Stepped pulley

Split pattern
3. Bent Pipe with core print
4. T-pipes with core print
5. Tumbles

Loose Piece Pattern
6. Dovetail

Core preparation
7. Core preparation for Bent pipe / T-pipe

Welding Section
1. Introduction of Safety in welding shop
2. Introduction to hand tools and equipment
3. Arc and gas welding equipment
4. Types of joints

Exercises :
Make the following welding joint / cutting.
Arc welding (Raw Material: 25 mm x 6mm MS flat)
1. Lap joint
2. Butt joint
3. T- joint

Gas Welding (Raw Material: 25mm x 3mm Ms flat)
4. Lap joint

Gas cutting: (GI/MS Sheet - 3mm thickness)
5. Profile cutting – circular profile

Spot welding: (GI/MS Sheet)
6. Lap joint

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name	:	DIPLOMA IN MECHANICAL ENGINEERING
Course Code	:	
Subject Code	:	M-537
Semester	:	III
Subject Title	:	**METROLOGY & METALLOGRAPHY PRACTICAL**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination				
METROLOGY & METALLOGRAPHY PRACTICAL	**Hours / Week**	**Hours / Semester**	**Marks**				**Duration**
	4	60	**Internal Assessment**	**Board Examination**	**Total**		3 Hrs
			25	75	100		

OBJCETIVES

- Familiarize about measuring techniques of Metrology instruments.
- Select the range of measuring tools.
- Obtain accurate measurements.
- Determine the least count of measuring instruments.
- Study the working principle of Microscope.
- Specimen preparation of ferrous and non-ferrous metals.
- Grinding, polishing and mounting of specimen.
- Non-destructive testing of metals for cracks.
- Crack detection – Visual inspection, Die penetration method
- Prepare the record of work for the exercises.

METROLOGY SECTION:

1. Introduction to linear measurement.

2. Introduction to angular measurement.
3. Introduction to geometric measurements.
4. Study of Least Count of measuring instruments.
5. Study of accuracy of instruments and calibration of instruments.
6. Study of Linear Measuring Instruments: Vernier Caliper, Micrometer, Inside Micrometer, Vernier Height gauge, Depth Gauge and Slip Gauge.
7. Study of Angular Measuring Instruments – Universal Bevel Protractor, Sine Bar.
8. Study of Geometric measurement - Gear tooth Vernier, Thread Micrometer.

Exercises:

1. Measure the dimensions of ground MS flat / cylindrical bush using Vernier Caliper compare with Digital / Dial Vernier Caliper.
2. Measure the diameter of a wire using micrometer and compare the result with digital micrometer
3. Measure the thickness of ground MS plates using slip gauges
4. Measure the angle of a V-block / Taper Shank of Drill / Dovetail using universal bevel protractor.
5. Measure the angle of the machined surface using sine bar with slip gauges.
6. Measure the geometrical dimensions of V-Thread using thread Vernier gauge.
7. Measure the geometrical dimensions of spur gear.

METALLOGRAPHY SECTION:
1. To study the micro structure of the metals using Metallurgical Microscope.
2. Determine the micro structure of the ferrous and nonferrous metals.
3. Prepare the specimen to study the microstructure.
4. Conduct the liquid penetration test to find the crack.
5. Conduct magnetic particle test to find cracks.

Exercises:
1. Find the grain structure of the given specimen using the Metallurgical Microscope.
2. Prepare a specimen to examine the micro structure of the Ferrous and Non-ferrous metal.
3. Detect the cracks in the specimen using Visual Inspection and ring test.
4. Detect of cracks in specimen using Die penetration test.
5. Detect the cracks in specimen using Magnetic particle test.

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name   :   **DIPLOMA IN MECHANICAL ENGINEERING**

Course Code   :

Subject Code   :   M-541

Semester : III

Subject Title : **HEAT POWER ENGINEERING**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	Instructions		Examination				
	Hours / Week	**Hours / Semester**	**Marks**				**Duration**
HEAT POWER ENGINEERING	6	90	**Internal Assessment**	**Board Examination**	**Total**		3 Hrs
			25	75	100		

Topics and Allocation of Hours:

Unit No	Topics	Hours
I	BASICS OF THERMODYNAMICS AND THERMODYNAMICPROCESSES OF PERFECT GASES	17
II	THERMODYNAMIC AIR CYCLES AND FUELS & COMBUSTION	17
III	AIR COMPRESSORS AND GAS TURBINES	17
IV	FORMATION & PROPERTIES OF STEAM AND STEAMCALORIMETERS	16
V	STEAM BOILERS AND PERFORMANCE OF BOILERS	16
	TEST AND REVISION	7
	Total	**90**

RATIONALE:
The knowledge on the concept of Thermodynamics, Thermodynamic Processes, Steady flow energy equation and steam properties and performance of Boilers are vital.

OBJECTIVES
- Explain a basics of systems, laws of thermodynamics and thermodynamic processes.
- Explain different types of Air Cycles.
- Explain the fuels ands combustion.
- Explain a air compressors and gas turbines.
- Explain a formation and properties of steam and steam calorimeters.
- Explain a steam boilers and performance of boilers.

HEAT POWER ENGINEERING
DETAILED SYLLABUS

UNIT I (17)
BASICS OF THERMODYNAMICS AND THERMODYNAMIC PROCESSES OF PERFECT GASES

Introduction:- Definitions and units of mass, weight, volume, density, specific weight, specific gravity and specific volume – pressure – units of pressure – temperature - absolute temperature – S.T.P and N.T.P conditions – heat - specific heat capacity at constant volume and at constant pressure – work – power – energy – types - law of conservation of energy – thermodynamic system – types – thermodynamic equilibrium - properties of systems – intensive and extensive properties – State of System - process – cycle – point and path functions - zeroth, first and second laws of thermodynamics.

Perfect gases: - laws of perfect gases – Boyle's, Charle's, Joule's, Regnault's and Avogadro's laws – General Gas Equation - Characteristic gas equation – relation between specific heats and gas constant – Universal gas constant –Change in Internal Energy-enthalpy – change in enthalpy – entropy.

Thermodynamic processes:- Constant volume, Constant pressure, Constant temp.(isothermal) ,Isentropic (reversible adiabatic) and,Polytropic Processes – p-V and T-s diagrams, work done , changein internal energy , heat transfer , change in enthalpy, change inentropy for above processes – Simple problems – hyperbolic ,Freeexpansion and throttling processes(Description only) .

Steady flow system: – control volume – steady flow energy equation – assumptions – Engineering applications.

UNIT II (17)
THERMODYNAMIC AIR CYCLES AND FUELS & COMBUSTION

Air cycles: – air standard efficiency – reversible and irreversibleprocesses – assumptions in deriving air standard efficiency – Carnotcycle – Otto cycle – Diesel cycle - Comparison of ideal and actualp-v diagrams of Otto and Diesel cycles – Simple problems

Fuels & Combustion:-Classifications of fuels - merits and demerits – requirements of agood fuel – Octane number – detonation - Pre-ignition – Cetanenumber – Diesel knock – comparison of detonation and diesel knock- fuel additives – Stages of Combustion – Delay period – Variablesaffecting delay period – Methods of generating air swirl in dieselengine combustion chambers – Types of combustion chambers –combustion equations – stoichiometric air required for completecombustion of fuels – excess air – products of combustion – analysisof exhaust gases - calorific value of fuels.

UNIT III (17)
AIR COMPRESSORS AND GAS TURBINES

Air Compressors:- Uses of compressed air – classifications of Air compressor – reciprocating compressor - single stage reciprocatingcompressor – compression processes – clearance volume and itseffects – volumetric efficiency – multi stage compression – meritsand demerits – Two stage compressor with imperfect cooling- with perfect inter cooling – rotary compressors – Roots blower - vaneblowers – centrifugal and axial flow air compressors – simpleproblems.

Gas turbines: – uses - classifications – merits and demerits -constant pressure combustion gas turbine – gas turbine withintercooler, reheater, regenerator - effects – closed cycle gasturbines - merits and demerits – jet propulsion - turbojet engines –turbo propeller engines – ramjet – Working principle - merits anddemerits –Rocket engines – applications of rockets.

UNIT V (16)
FORMATION & PROPERTIES OF STEAM AND STEAM

Calorimeters: Steam - Properties – formation of steam – saturation temperature –enthalpy of water – enthalpy of evaporation – conditions of steam –dryness fraction – enthalpy of wet, dry and superheated

steam -advantages of superheated steam – p-v diagram - T-H diagram –T-S diagram - H-S diagram – P-H diagram – critical conditions ofwater – specific volume of water and steam – density of steam –external work done during evaporation – internal latent heat –internal energy of steam – entropy of water and steam – steamtables - Mollier chart.

Expansion process of Steam: Constant Volume process –Constant Pressure Process – Constant Temperature process –Hyperbolic Process – Isentropic process – Polytrobic process – Throttling process. – Simple problems.

Steam Calorimeter: Determination of dryness fraction of steam –bucket calorimeter - combined separating and throttling calorimeters.

UNIT V   **(16)**
STEAM BOILERS AND PERFORMANCE OF BOILERS
Steam Boilers: Introduction - Classification of boilers – comparisonof fire tube and water tube boilers – high pressure boilers –   advantages of high pressure boilers - Lamont and BHEL high pressure boilers – boiler mountings and accessories - function - construction and working – comparison of mountings and accessories – feed water treatment – internal and external treatments - starting boiler from cold condition – safety precautions in boiler operation – causes of Indian boiler act.

Performance of boilers: Evaporation rate - actual, equivalent and factor of evaporation – boiler efficiency – factors influencing boiler efficiency - boiler power – Simple problems – boiler plant - efficiency of economizer and super heater – Simple problems - boiler trial – heat losses in a boiler- heat balance sheet – Simple problems

Text Book:
1. Thermal Engg, R.K .Rajput , ,8th Edition, Laxmi publications, Pvt Ltd , New Delhi.
2. Applied Thermodynamics ,P.K. Nag, ,2nd Edition,TATAMcgraw - Hill Publishing Company,New Delhi .
3. ThermalEngineering,R.S.KhurmiandJ.K.Gupta,18thEdition,S.Chand&Co,NewDelhi

Reference Books:
1. Thermal Engineering ,P.LBallaney , 24th Edition ,Khanna Publishers, New Delhi.
2. Thermal Engineering ,B.K. Sarkar , 3rd Edition , DhanpatRai& Sons New Delhi .
3. Applied Thermodynamics, Domkundwar and .P.Kothandaraman, 2ndEdition, Khanna publishers, New Delhi.

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name	:	DIPLOMA IN MECHANICAL ENGINEERING
Course Code	:	
Subject Code	:	M-542
Semester	:	IV

Subject Title : **SPECIAL MACHINES**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination				
	Hours / Week	**Hours / Semester**	**Marks**				**Duration**
SPECIAL MACHINES	5	75	**Internal Assessment**	**Board Examination**	**Total**		3 Hrs
			25	75	100		

Topics and Allocation of Hours:

Unit No	Topics	Hours
I	MANUFACTURING OF PLASTIC COMPONENTSAND COMPOSITEMANUFACTURING	14
II	RECIPROCATING MACHINES AND BROACHING MACHINE	14
III	MILLING MACHINES AND GEAR GENERATING PROCESSES	14
IV	ABRASIVE PROCESS AND NON- CONVENTIONAL MACHININGPROCESSES	13
V	CNC MACHINE AND ITS COMPONENTS	13
	TEST AND REVISION	7
	TOTAL	**75**

RATIONALE:
Manufacturing, the major and the most important aspect in industries needs utmost care and attention. Knowledge about various processes and allied areas will be of great use to the personnel involved in production. This will provide the students an opportunity to skill themselves for the industrial scenario.

OBJCETIVES
- Acquire Knowledge about types of pattern, casting, and moulding.
- Describe the various casting processes.
- Knowledge about various welding process and its working principle.
- Appreciate the safety practices used in welding.
- Acquire knowledge about various forming technologies.

- Knowledge about the lathe and its working parts.
- Describe the functioning of semi-automatic lathes.
- Study about the drilling process.
- Study about metrology and measuring instruments.

SPECIAL MACHINES
DETAILED SYLLABUS

UNIT I (14)
MANUFACTURING OF PLASTIC COMPONENTS
Plastic Components: Types of plastics - Engineering plastics –thermosets – composite - structural foam, elastomers - polymer alloysand liquid crystal polymers. Factors Influencing the Selection OfPlastics - Mechanical properties – degradation - wear resistance -frictional properties - special properties –processing – cost
Processing of Plastics: Extrusion-general features of single screwextrusion -twin screw extruders.**Injection moulding types:** Plunger type- Reciprocating screw injection - details of injection mould– structuralfoam injection mould - sandwich moulding - gas injection moulding -injection moulding of thermosetting materials - calendaring androtational moulding. Design consideration for plastic components.
Composite manufacturing: Introduction – characteristics ofcomposite manufacturing - constituents – Glass fibers manufacturingprocess – hand laminating process – autoclave processing – filamentwinding – pultrusion process – liquid composite process – workingprinciples by schematic diagram only – advantages – disadvantages.

UNIT II (14)
RECIPROCATING MACHINES
Planer: Introduction - description of double housing planer –specifications -principles of operation – drives - quick returnmechanism - feed mechanism - work holding devices and specialfixtures - types of tools - operations.
Shaper: Introduction – specifications – principles of operationstandard shaper – quick return mechanism - crank and slotted link –hydraulic shaper - feed mechanism - work holding devices – fixture - operations.
Slotter: Introduction – specifications - method of operation –Whitworthquick return mechanism - feed mechanism - work holding devices -types of tools.
Broaching: Types of broaching machine - horizontal, vertical andcontinuous broaching - principles of operation - types of broaches –classification - broach tool nomenclature - broaching operations.
UNIT III (14)
MILLING MACHINES AND GEAR GENERATING PROCESSES
Milling Machines: Types - column and knee type – plain – universalmilling machine - vertical milling machine - principles of operation - specification of milling machines - work holding devices - tool holding devices - arbor - stub arbor - spring collet – adapter.
Milling cutters: cylindrical milling cutter - slitting cutter -side milling cutter - angle milling cutter - T-slot milling cutter - woodruff milling cutter - fly cutter - nomenclature of cylindrical milling cutter.
Milling operations: straddle milling - gang milling - vertical milling attachment.
Indexing plate – differential indexing - simple indexing – compound indexing – simple problems.
Generating Process: gear shaper - gear hobbing - principle of operation only.
Gear finishing processes:burnishing – shaving - grinding and lapping - gear materials.

UNIT IV **(13)**

ABRASIVE PROCESS AND NON- CONVENTIONAL MACHINING PROCESSES

Abrasive Process: Types and classification – specifications – roughgrinding – pedestal grinders - portable grinders - belt grinders -precision grinding - cylindrical grinder - centerlessgrinders – surface grinder - tool and cutter grinder - planetary grinders - principles ofoperations - grinding wheels – abrasives - natural and artificialdiamond wheels - types of bonds - grit, grade and structure of wheels -wheel shapes and sizes - standard marking systems of grindingwheels - selection of grinding wheel - mounting of grinding wheels - Dressing and Truing of wheels - Balancing of grinding wheels.

Non-Conventional Machining Processes: Construction, working andapplications of Ultrasonic machining - chemical machining – electrochemical grinding - electrical discharge machining - plasma arcmachining - LASER machining - Advantages – Disadvantages.

UNIT V **(13)**

CNC MACHINE AND ITS COMPONENTS

CNC Machines: Numerical control – definition – working principle of aCNC system – Features of CNC machines - advantage of CNC machines – difference between NC and CNC – Construction andworking principle of turning centre – Construction and working principleof machining centre – machine axes conventions turning centre andmachining centre – Coordinate measuring machine – construction andworking principle.

Components of CNC machine: Slide ways – requirement – types –friction slide ways and antifriction slide ways - linear motion bearings – recirculation ball screw – ATC – tool magazine – feedback devices – linear and rotary transducers – Encoders - in process probing - tool material – tool inserts.

Text Books:
1. 1.Elements of Workshop Technology- Vol. I & II, HajraChoudry&Battacharya,   Edn.11, published byMedia Promoters and Publishers Pvt. Ltd.,SeervaiBuildings `B', 20-G, NoshirBharuchaMarg,Mumbai 400 007 – 2007.
2. Production Technology, Jain & Gupta, Khanna Publishers, 2-B, North Market,Naisarak, New Delhi –   110 006 – 2006.

Reference Books:
1. Production Technology, HMT, Edn. 18, published by Tata McGraw Hill Publishing Co. Ltd., 7, West Patel Nagar, New Delhi 110 008.
2. Manufacturing process, Myro N Begman, ,Edn. 5, Tata McGraw Hill Publishing Co. Ltd., 7, West Patel Nagar, New Delhi 110 008.
3. Workshop Tech Vol I,II, III, WAJ. Chapman, published by Viva Books Pvt. Ltd., 4262/3, Ansari Road, Daryaganj, New Delhi 110 002.
4. Production processes, NITTTR, published by 5, Tata McGraw Hill Publishing Co. Ltd., West Patel Nagar, New Delhi 110 008.
5. Principles of the manufacturing of Composite materials – Suong V Hoa, DES tech publication. Inc, 439, North Duke street, Lancaster, Pennsylvania – 17602 U.S.A.

Course Name	:	DIPLOMA IN MECHANICAL ENGINEERING
Course Code	:	
Subject Code	:	M-543
Semester	:	IV
Subject Title	:	**ELECTRICAL DRIVES AND CONTROL**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination			
ELECTRICAL DRIVES AND CONTROL	Hours / Week	Hours / Semester	Marks			Duration
	6	90	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

Topics and Allocation of Hours:

Unit No	Topics	Hours
I	DC CIRCUITS AND DC MACHINES	17
II	AC CIRCUITS AND AC MACHINES	17
III	STEPPER AND SERVO MOTORS & DRIVES	17
IV	POWER SUPPLIES AND LOGIC GATES	16
V	CONTROL ELEMENTS AND PLC	16
	TEST AND REVISION	7
	TOTAL	**90**

RATIONALE:
The automation is being the order of the day to improve the production with high quality consciousness. Such automation involves electrically operated switches, sensors controlled through electrically driven motors and actuators. The subject aims in introducing the basic electrical DC and AC circuits and motors and also focuses on the various special control devices like stepper, servo drives and its controlling elements.

OBJECTIVES:
- Explore fundamental electric circuit laws.
- Explain the working principle of DC and AC Electrical machines.
- Identify the effective uses of drives of Electrical machines.
- Analyze the various power supply circuits.
- Select the field controlled elements.
- Explain the construction and working of Transformer.
- Compare the different types of Logic gates.

- Appreciate the safety practices followed in Electrical system.
- Compare the use of servo motors and stepper motors in electrical driving system
- Identify PLC Input outputs.
- Identify the use of Control elements.

ELECTRICAL DRIVES & CONTROL
DETAILED SYLLABUS

UNIT I (17)
DC CIRCUITS AND DC MACHINES
Definition- Electric current, voltage and resistance -Ohm's law andKirchoff's law. Resistance in series and parallel and series, parallel –simple problems electromagnetism(definitions only) – magnetic flux,
flux density magnetic field intensity, MMF, permeability, reluctance,Faraday's law of electromagnetic induction, electrical and mechanicalunitsDC generators – construction, principle of operation, types andapplication.
DC motors: - construction, principle of operation, types andapplication.
Necessity of starters: Three point, four point starters.

UNIT II (17)
AC CIRCUITS AND AC MACHINES
Fundamentals of AC voltage, and current – peak, average, RMSvalue of sine wave, frequency, time period, amplitude, power andpower factor (definition only)- star and delta connection relationshipbetween phase, line voltage and current in star and deltaconnections.
Transformer: Principle of operation and construction – EMF equation (no definition)- losses in Transformer – efficiency – application.Alternator construction – principle of operation – types andapplications.
AC machine: AC motors- Principle of operation of single phasecapacitor start and universal motor induction motor- applications-Three phase induction motors – Squirrel cage and slip ring Inductionmotors (construction and working principle only) - application – speedcontrol of 3Φ Induction motor -Necessity of starters – DOL andstar/delta starter.

UNIT III (17)
STEPPER AND SERVO MOTORS & DRIVES:
PMDC, Stepper motor- construction and working principle andapplications - Servo motor – types: brushless servo motor, permanentmagnet servo motor construction and applications.
Industrial drives:- types, group drive, individual drive, multi motor drive,block diagram of Variable frequency drive , stepper motor drive:single stepping and half stepping. Servo drives.
Electrical safety: - importance of earthing - electric shock: first aid,precautions - causes of accident and their preventive measures.Energy conservation

UNIT IV (16)
POWER SUPPLIES AND LOGIC GATES
Diode – terminals: anode and cathode, forward biasing and reversebiasing – use of diode in rectifiers – half wave and full wave – necessity of filters- Regulated power supplies: IC voltage regulators – SMPS, UPS and Inverters – General description and their applications.

Display devices – LED, 7 segment LED, LCDLogic gates: Positive and negative logic, definition, symbol truth table,Boolean expression for OR, AND, NOT, NOR, NAND, EXOR ANDEXNOR gates – Universal logic Gates: NAND, and NOR.

UNIT V (16)
CONTROL ELEMENTS AND PLC

Fuses:– selection of fuse – necessity of fuse- fuse switch units. Sensors: Photo electric sensor, Inductive proximity sensors, Temperature sensors.

Switches: Push button switch, selector switch, limit switch, pressure switch,temperature switch, float switch and reed switch.Relays – NO, NC – usage- bimetallic thermal overload relays. Contactors- usage – necessity of contactor- Solenoid type contactor Circuit breakers – Miniature case Circuit breaker (MCCB) and Miniature Circuitbreaker (MCB), Oil Circuit breakers (OCB), Earth leakage circuit breaker (ELCB)

PLC: Features of PLC-PLC Block diagram- PLC scan - Fixed and modular PLC Ladder logic-NO, NC contacts-Coils-AND, OR.

Text Books:
1. A course in electrical engineering - B.L.Theraja - Multi Colour Edition, S Chand & Co, Reprint 2006
2. Control of Machines - S.K Bhattacharya, Brijinder Singh – New Age Publishers, Second Edition-Reprint 2010
3. Electronic Circuits & System- Analog and Digital – Y.N.Bapat - Tata McGraw Hill.

Reference Books:
1. Electrical Technology – Hughes - 8th Edition, Pearson Education.
2. Electronic Device and Circuits- An introduction – Allen Mottershed - Prentice Hall of India.

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name   :   DIPLOMA IN MECHANICAL ENGINEERING

Course Code   :

Subject Code   :   M-544

Semester   :   IV

Subject Title   :   **COMPUTER APPLICATIONS AND CAD PRACTICAL**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination				
COMPUTER APPLICATIONS AND CAD PRACTICAL	**Hours / Week**	**Hours / Semester**	**Marks**				**Duration**
	6	90	**Internal Assessment**	**Board Examination**	**Total**		3 Hrs
			25	75	100		

OBJECTIVES:
- On completion of the exercises, the students must be able to
- Use the different facilities available in the word processor
- Analyze the data sheet
- Create and manipulate the database
- Prepare PowerPoint presentation
- Practice on CADD commands in making 2D Drawings.
- Draw assembled drawings using CADD.
- Draw sectional views using different types of sections

PART – A: COMPUTER APPLICATIONS (30 Hrs)

WORD PROCESSING

Introduction – Menus – Tool bar – Create – Edit – Save – Alignment – Font Size – Formatting – Tables – Fill Colors – Page Setup - Preview – Water marking – Header– Footer – Clip art.

Exercises

Create a news letter of three pages with two columns text. The first page contains some formatting bullets and numbers. Set the document background colour and add 'confidential' as the watermark. Give the document a title which should be displayed in the header. The header/ footer of the first page should be different from other two pages. Also, add author name and date/ time in the header. The footer should have the page number.

Create the following table using align, border, merging and other attributes.

DIRECTORATE OF TECHNICAL EDUCATION - E-GOVERNANCE PARTICULARS					
Register Number	June	July	August	September	Cumulative %
16304501					

16304502					
16304503					
16304504					
16304505					

SPREADSHEET
Introduction – Menus – Tool bar – Create – Edit – Save – Formatting cells – Chart wizard – Fill Colors – Creating and using formulas – Sorting – Filtering.

Exercises
Create a table of records with columns as Name and Donation Amount. Donation amount should be formatted with two decimal places. There should be at least twenty records in the table. Create a conditional format to highlight the highest donation with blue colour and lowest donation with red colour. The table should have a heading.
Prepare line, bar and pie chart to illustrate the subject wise performance of the class for any one semester.

DATABASE
Introduction – Menus – Tool bar – Create – Edit – Save – Data types – Insert – Delete – Update – View – Sorting and filtering – Queries – Report – Page setup – Print.

Exercises
Prepare a payroll for employee database of an organization with the following details: Employee Id, Employee name, Date of Birth, Department and Designation, Date of appointment, Basic pay, Dearness Allowance, House Rent Allowance and other deductions if any. Perform simple queries for different categories.
Design a pay slip for a particular employee from the above database.

PRESENTATION
Introduction – Menus – Tool bar – Create – Edit – Save – Slide transition – Insert image – Hyper link – Slide numbers – View slide show with sound – Photo album – Clip art.

Exercises
Make a presentation with atleast 10 slides. Use different customized animation effects on pictures and clip art on any four of the ten slides.

PART – B: CAD (60 Hrs)

INTRODUCTION
Introduction – History of CAD – Applications – Advantages over manual drafting – Hardware requirements – Software requirements – Windows desktop – CAD screen interface – menus – Tool bars – How to start CAD – How to execute command – types of co-ordinate systems – Absolute – Relative – Polar.

DRAWING AIDS AND EDITING COMMANDS

Creating objects (2D) – Using draw commands – Creating text – Drawing with precision – Osnap options – drafting settings – drawing aids – Fill, Snap, Grid, Ortho lines – Function keys - Editing and modify commands – Object selection methods – Erasing object – Oops - Cancelling and undoing a command – Copy – Move – Array– Offset – Scale – Rotate – Mirror – Break – Trim – Extend – Explode. Divide – Measure – stretch – Lengthen – Changing properties – Color – line types –LT scale– Matching properties – Editing with grips – Pedit – Ddedit – Mledit.

BASIC DIMENSIONING, HATCHING, BLOCKS AND VIEWS

Basic dimensioning – Editing dimensions – Dimension styles – Dimension system variables.Machine drawing with CAD. Creation of blocks – Wblock – inserting a block – Block attributes – Hatching –Pattern types – Boundary hatch – working with layers - Controlling the drawing display – Blipmode – View group commands – Zoom, redraw, regen, regenauto, pan, viewers – Real time zoom. Inquiry groups – calculating area – Distance – Time – Status of drawing – Using calculator.

CAD EXERCISES

Detailed drawings of following machine parts are to be given to students. Draw the assembled views (two views only) and bill of materials.
The elevation / sectional elevation / plan / sectional plan / side view with dimensioning.

- Sleeve & Cotter joint
- Screw jack
- Plummer Block
- Simple Eccentric
- Machine Vice
- Protected type flanged coupling

Reference Books:

1. Inside AutoCAD - D. Raker and H. Rice - BPB Publications, NewDelhi
2. Engineering Drawing and Graphics + AutoCAD – K.Venugopal, - New Age International Publications
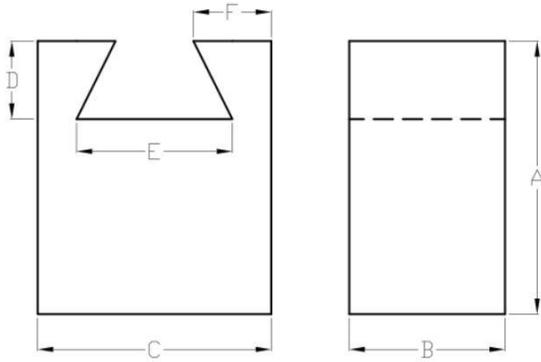3. AutoCAD with Applications - Sham Tickoo - Tata Mcgraw Hill.

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name	:	DIPLOMA IN MECHANICAL ENGINEERING
Course Code	:	
Subject Code	:	M-545
Semester	:	IV
Subject Title	:	**SPECIAL MACHINES PRACTICAL**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
SPECIAL MACHINES PRACTICAL	4	60	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

OBJCETIVES

- Identify a milling machine and its parts
- Identify a cylindrical grinder, surface grinder and tool and cutter grinder
- Identify shaper, Slotter and its parts
- Identify the tools and instruments used in milling.
- Handle the different types of work holding devices
- Machine a component using different machine tools.
- Calculate the indexing for a work
- Machine a gear using milling machine.
- Machine a cutting tool using Tool and Cutter grinder.
- Machine a plug gauge using Cylindrical grinding machine.
- Machine components by shaping machine
- Machine components by slotting machine
- Prepare a record of work for all the exercises.

EXERCISES: **Raw Material: M.S. / C.I**

1.Make 'V' Block using shaping machine

Dimensions			
Sl.No	Part Name	Actual	Obtained

2.Make dovetail using shaping machine

Dimensions			
Sl.No	Part Name	Actual	Obtained

3.Make groove cut using slotting machine
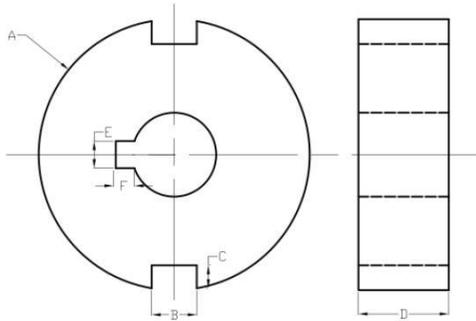
Dimensions			
Sl.No	Part Name	Actual	Obtained

4.Make round to square in milling machine.
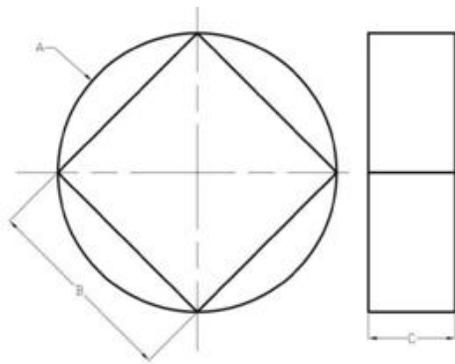
Dimensions			
Sl.No	Part Name	Actual	Obtained
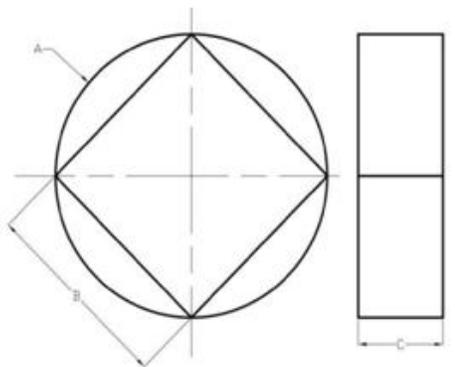
Dimensions			
Sl.No	Part Name	Actual	Obtained

5.Make Spur Gear using milling machine by Differential Indexing.

SPUR GEAR M1.5
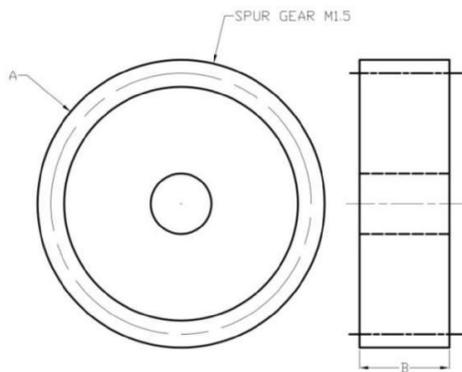
Dimensions			
Sl.No	Part Name	Actual	Obtained

6.Make Helical Gear using milling machine

HELICAL GEAR M1.5
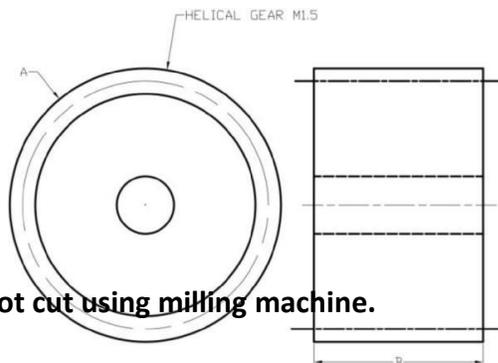
Dimensions			
Sl.No	Part Name	Actual	Obtained

7.Make slot cut using milling machine.
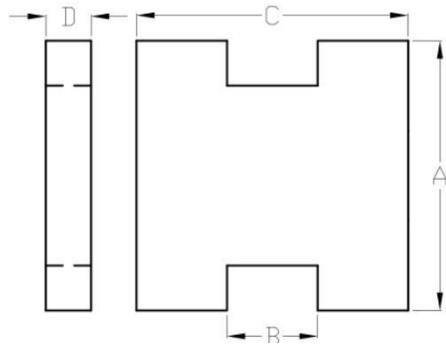
Dimensions			
Sl.No	Part Name	Actual	Obtained

8.Make Progressive type Plug gauge using Cylindrical Grinding machine
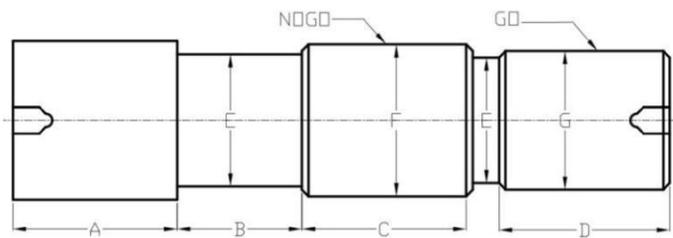
Dimensions			
Sl.No	Part Name	Actual	Obtained

9.Make a turning tool using Tool and Cutter Grinder
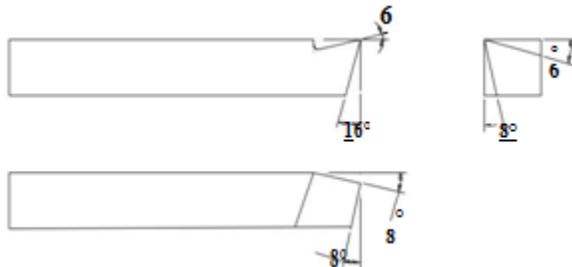
Dimensions			
Sl.No	Part Name	Actual	Obtained

10. Make plain surfaces (four surfaces) using surface Grinder

Dimensions			
Sl.No	Part Name	Actual	Obtained

M-SCHEME

Course Name   :   DIPLOMA IN MECHANICAL ENGINEERING

Course Code   :

Subject Code   :   M-546

Semester   :   IV

Subject Title   :   **LATHE AND DRILLING PRACTICAL**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination				
LATHE AND DRILLING PRACTICAL	**Hours / Week**	**Hours / Semester**	**Marks**				**Duration**
	4	60	**Internal Assessment**	**Board Examination**	**Total**		3 Hrs
			25	75	100		

OBJECTIVES:

1. Identify the parts of a lathe.
2. Identify the work holding devices.
3. Set the tools for various operations.
4. Operate the lathe and machine a component using lathe.
5. Identify the parts of drilling machine.
6. Perform the various drilling operations.
7. Identify the various tools and its holding devices.
8. Identify the work holding devices.
9. Prepare the record of work for the exercises.

Lathe section:

1. Introduction of safety in operating machines.
2. Study of lathe and its parts.
3. Types of tools used in lathe work.
4. Study of work holding devices and tool holding devices.
5. Setting of work and tools.
6. Operation of lathe.
7. Practice on a lathe.
8. Types of measuring instruments and their uses.

Exercises:

Make the following jobs in the lathe. Raw material   - 32 mm M.S. Rod

1. Facing, Step turning & Chamfering
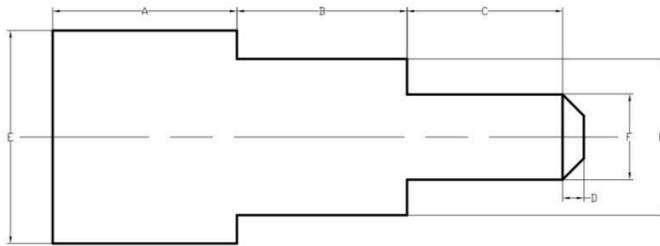
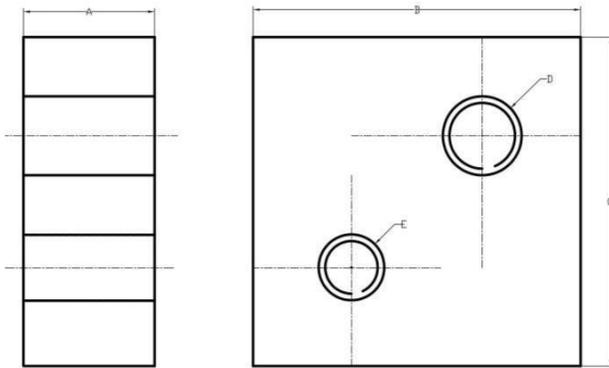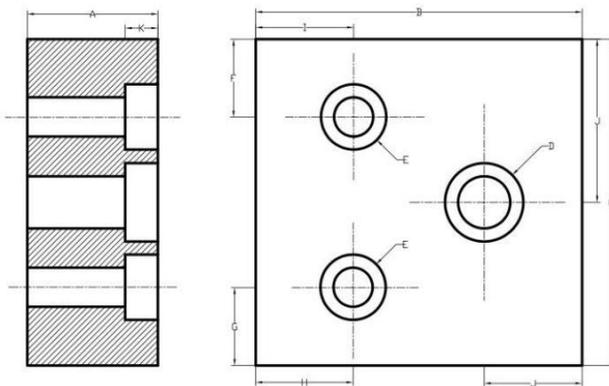| Dimensions			
Sl.No	Part Name	Actual	Obtained

2. Step turning & Groove cutting
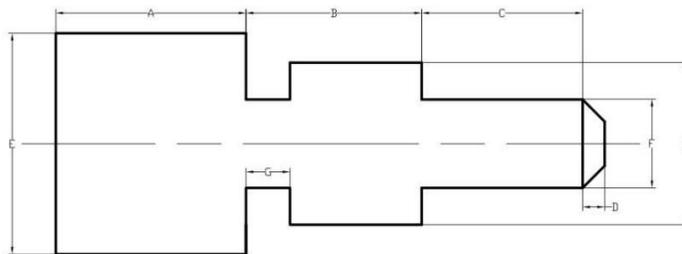
Dimensions			
Sl.No	Part Name	Actual	Obtained

3. Step turning & Taper turning
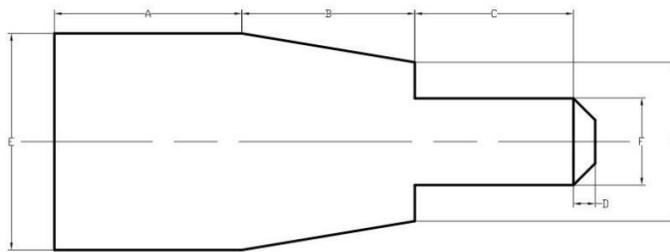
Dimensions			
Sl.No	Part Name	Actual	Obtained

4. Step turning & Knurling
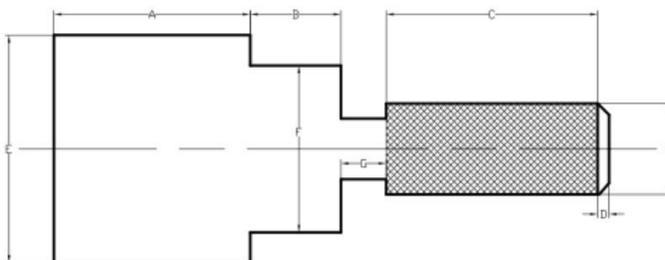
Dimensions			
Sl.No	Part Name	Actual	Obtained

5. Step turning & Thread cutting (L.H.)

Dimensions			
Sl.No	Part Name	Actual	Obtained
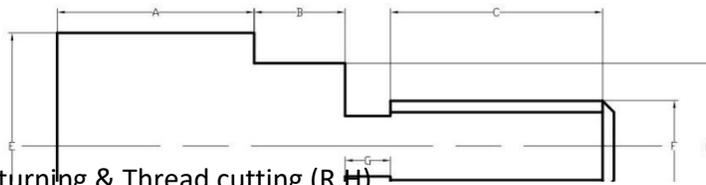
6. Step turning & Thread cutting (R.H)
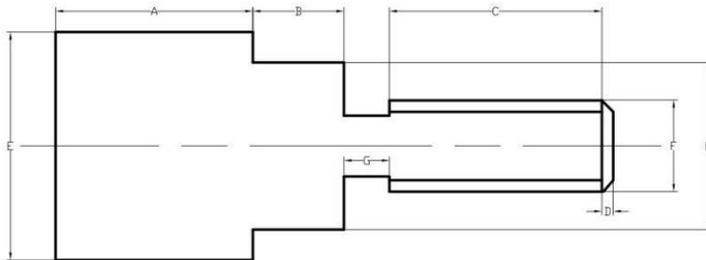
Dimensions			
Sl.No	Part Name	Actual	Obtained

7. Bush: Turning & Drilling
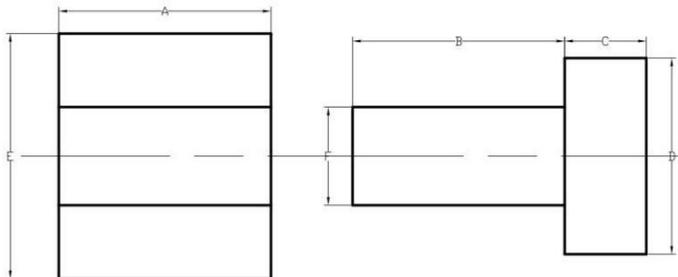
Dimensions			
Sl.No	Part Name	Actual	Obtained

8. Eccentric turning
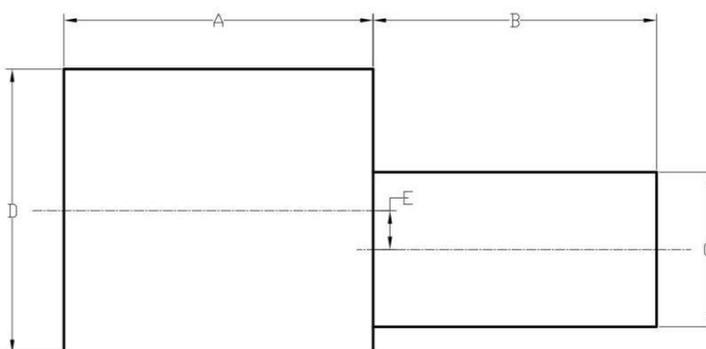
Dimensions			
Sl.No	Part Name	Actual	Obtained

Drilling section:

1. Introduction of safety in operating machines.
2. Study of drilling machines and its parts.
3. Study the types of tools used.
4. Study of work holding devices and tool holding devices.

5. Setting of work and tools.
6. Operation and practice.
7. Types of measuring instruments and their uses.

Exercises:

Make the following jobs in the drilling machine.
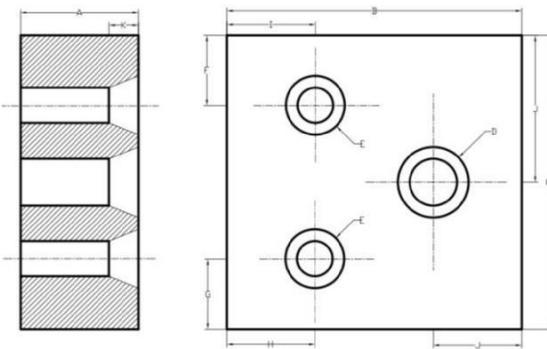**Raw material 50mm X 50mm X 20 mm thick M.S. Flat**

1. Drilling & Tapping

Dimensions			
Sl.No	Part Name	Actual	Obtained

2. Drilling &Counter boring

Dimensions			
Sl.No	Part Name	Actual	Obtained

3. Drilling &Counter sinking

Dimensions			
Sl.No	Part Name	Actual	Obtained

4. Drilling and Reaming – Radial drilling machine
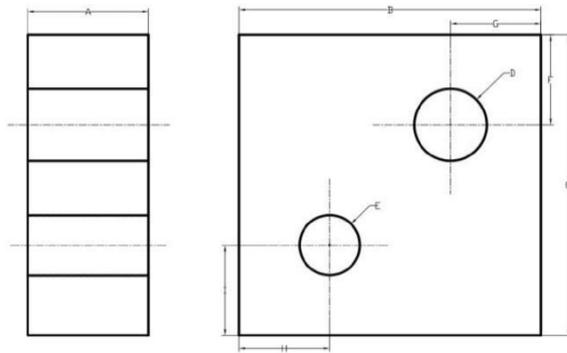
	Dimensions		
Sl.No	Part Name	Actual	Obtained

BOARD EXAMINATION

Note: All the exercises in both sections have to be completed. Two exercises will be given for examination by selecting one exercise in each section. All the exercises should be given in the question paper and students are allowed to select by a lot.

Record note book should be submitted during examination.

Lathe	:	**45 marks (2hours)**	
Procedure / Preparation		10	
Machining / Dimensions		25	
Surface Finishing		10	
Drilling	:	**25 marks (1 hour)**	
Procedure / Marking		10	
Dimensions		10	
Surface Finishing		5	
Viva-voce	:	**05 marks**	
Total	:	**75 marks**	

LIST OF EQUIPMENT

Lathe Section
1. Lathe (Minimum 4 ½') - 13 Nos.
2. All geared lathe - 2 Nos.
3. 4 Jaw / 3 Jaw Chucks - Required Numbers
4. Chuck key - Required Numbers
5. Spanner - Sufficient quantity
6. Cutting Tools - Sufficient quantity
7. Pitch gauge - 5 Nos.
8. Thread gauge - 5 Nos.
9. Vernier Caliper - 5 Nos.

10. Snap gauges	-	Sufficient quantity
11. Steel Rule (0-150)	-	Sufficient quantity
12. Calipers (Inside / Outside / Jenny)	-	Sufficient quantity
13. Dial Gauge with Magnetic Stand	-	Sufficient quantity
14. Marking Gauge	-	Sufficient quantity
15. Safety Glass	-	15 Nos.

Drilling Section

1.	Upright drilling machine	-	2 Nos.
2.	Radial drilling machine	-	1 No.
3.	Drill bit & Tap set	-	Sufficient quantity
4.	Reaming bit	-	Sufficient quantity
5.	Counter sinking bit	-	Sufficient quantity
6.	Counter boring bit	-	Sufficient quantity
7.	Plug gauges	-	Sufficient quantity
8.	Vernier Height Gauge	-	1 No.
9.	Surface plate	-	2 Nos.

M-SCHEME

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code :

Subject Code : M-547

Semester : IV

Subject Title : **ELECTRICAL DRIVES AND CONTROL PRACTICAL**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
ELECTRICAL DRIVES AND CONTROL PRACTICAL	4	60	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

OBJCETIVES

1. Identify starters for different motors.
2. Study and prepare earthing
3. Test the characteristics of DC and AC machines.
4. Identify and select controlling elements.
5. Explore the performance of ELCB, MCB.
6. Design regulated power supplies.
7. Identify display devices - LED, 7 segment LED, LCD.
8. Identify the drive circuit for special motors.
9. Test the speed control circuit of the special motors

LIST OF EXPERIMENTS:
Part A:

1. Verification of Ohm's Law
2. Testing of DC starters – 3 point and 4 point starter
3. Load test on DC shunt motor
4. Testing of AC starters - DOL , star - Delta starter

5. Load test on single phase induction motor
6. Load test on three phase squirrel cage motor
7. Testing of relays, contactors, push buttons and limit switch
8. Connection and Testing of MCB, ELCB

Part B
1. Construction and testing of Half wave and Full wave rectifier.
2. Construction and testing of IC voltage regulator using IC 7805.
3. Verification of truth tables for logic gates.
4. Verification of universal gates.
5. Identification and testing of display devices- LED, 7 segment LED, Laser diode.
6. Testing of Stepper motor drive.
7. Testing of Servo motor drive.

(Implements from the Academic year 2015-2016 onwards)

Course Name	:	**DIPLOMA IN MECHANICAL ENGINEERING**
Course Code	:	
Subject Code	:	M-551
Semester	:	V
Subject Title	:	**DESIGN OF MACHINE ELEMENTS**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	Instructions		Examination				
	Hours / Week	**Hours / Semester**	**Marks**				**Duration**
DESIGN OF MACHINE ELEMENTS	6	90	**Internal Assessment**	**Board Examination**	**Total**		3 Hrs
			25	75	100		

Topics and Allocation of Hours:

Unit No	Topics	Hours
I	DESIGN OF JOINTS AND FASTENERS	17
II	DESIGN OF SHAFTS, COUPLINGS AND KEYS	17
III	DESIGN OF FRICTION DRIVES (FLAT BELT AND V BELT)	17
IV	DESIGN OF BEARINGS	16
V	DESIGN OF LEVERS AND SPUR GEARS	16
	TEST AND REVISION	7
	Total	**90**

RATIONALE:

The main objective of Machine Design is to create new and better machine components to improve the existing one. A mechanical engineer should have thorough knowledge of design of machine elements to avoid the failure of machines or components.

OBJECTIVES

- Design riveted joints, welded joints, sleeve and cotter joint and knuckle joint.
- Design eye bolts, cylinder cover studs.
- Design shafts, keys and couplings required for power transmission.
- Compare the different types of couplings.
- Design flat and V-belt for power transmission.
- Study the various types of bearings and their applications.
- Design journal bearings.
- Design spur gear used for power transmission.
- Design hand lever, foot lever and cranked lever.

DESIGN OF MACHINE ELEMENTS
DETAILED SYLLABUS

UNIT I (17)

ENGINEERING MATERIALS, JOINTS AND FASTENERS

General Considerations in Machine Design: Engineering materials - Factors affecting selection of material – BIS designation of Ferrous materials – Preferred number - Factor of safety and allowable stress – Stresses: Tension, Compression, Shear, Bearing pressure Intensity, Crushing, bending and torsion - problem.

Creep strain and Creep Curve- Fatigue, S-N curve, Endurance Limit - Stress Concentration – Causes & Remedies

Theories of Elastic Failures – Principal normal stress theory, Maximum shear stress theory & maximum distortion energy theory.

Joints: Design of sleeve and cotter joint, knuckle joint and welded joint.

Fasteners: Design of bolted joints - eye bolts.

UNIT II (17)

DESIGN OF SHAFTS, KEYS AND COUPLINGS

Shafts: Design of shafts subjected to – twisting moment – bending moment – combined twisting and bending moments – fluctuating loads – design of shafts based on rigidity.

Keys: Types of keys - design of sunk keys only - Effect of keyways on shaft-problems.

Couplings: Requirements of good couplings – types - design of – rigid protected type flange couplings - marine couplings – pin type flexible coupling (Description only).

UNIT III (17)

DESIGN OF FLAT BELTS AND V-BELTS

Flat Belts: Types of belts - materials for belt -– types of belt drives – Speed ratio – effect of slip - length of flat belts –Tension Ratio $T1/T2 = e^{\mu\theta}$ – centrifugal tension - power transmitted – condition for maximum power - transmission – Initial Tension - problems – design procedure of flat belts - design of flat belt based on manufacturer's data only – problems.

V-Belts: V-belt drive - comparison with flat belt drive - designation of V-belts – length of belt - power transmitted – Design of V-belt   using manufacturer's data only – Problem.

UNIT IV   (16)
DESIGN OF BEARINGS
Bearings: Classifications of bearings – sliding contact and rolling contact bearings - radial and thrust bearings - roller bearing – types - Designation of ball bearings - materials used for bearings – journal bearings - heat generated - heat dissipated - cooling oil requirement – problems - design of journal bearings –Problems.
Design based on approved data books only.

UNIT V   (16)
DESIGN OF LEVERS AND SPUR GEARS
Levers: Types of levers – applications - mechanical advantage – leverage - displacement ratio - design of-hand lever-foot lever-cranked lever - problems.

Spur gears: Gear drives - merits and demerits over belt drive – Classification of gears - gear materials - spur gear terminology - design of spur gears based on Lewis & Buckingham equation - Problems – speed reducer – types –(Approved data books only).

Text Book:
1. Machine Design, Pandya& Shah, Edn. 1995, Charotar Publishing House.
2. Machine Design,T. V. Sundararajamoorthy& N. Shanmugam, Revised   Edition,   June-2003– Anuradha Publications, Kumbakonam.
3. Design Data Book – by PSG College of Technology, DPV Printers, Coimbatore.

Reference Books:
1. A text book of Machine Design, R.S. Khurmi&J.K.Gupta, Edn. 18,Eurosia Publishing House Pvt. Limited, New Delhi-110 055.
2. Machine Design – Bandari.
3. Theory and Problems of Machine Design, Holowenko, Laughlin, Schaum's outline Series.

<div align="center">

END EXAMINATIONS QUESTION PATTERN
</div>

Note: 1. Five questions will be asked, one question from each unit in either or pattern. All the five questions are to be answered.
2. Each question carries 15 marks. These questions may have sub-divisions also.
3. P.S.G. DESIGN DATA BOOK IS PERMITTED. (Required abstract pages of the P.S.G. Design Data Book Certified by the Chief Supdt. may be permitted.)

(Implements from the Academic year 2015-2016 onwards)

Course Name   :   DIPLOMA IN MECHANICAL ENGINEERING

Course Code   :

Subject Code   :   M-552

Semester   :   V

Subject Title   :   **THERMAL ENGINEERING**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination				
THERMAL ENGINEERING	**Hours / Week**	**Hours / Semester**	**Marks**				**Duration**
	5	75	**Internal Assessment**	**Board Examination**	**Total**		3 Hrs
			25	75	100		

Topics and Allocation of Hours:

Unit No	Topics	Hours
I	INTERNAL COMBUSTION ENGINES	14
II	PERFORMANCE OF I.C ENGINES AND HEAT TRANSFER	14
III	THERMAL POWER PLANT AND STEAM TURBINES AND CONDENSERS	14
IV	REFRIGERATION AND AIR CONDITIONING	13
V	CONVENTIONAL SOURCES OF ENERGY AND NUCLEAR POWER PLANT	13
	TEST AND REVISION	7
	TOTAL	**75**

RATIONALE:
Study of thermal power plant, Nuclear power plant, turbines and condensers are required to know about the generation of electric power. The study about the Refrigeration and Air-

conditioning are required. The study about modes of heat transfer is required to analyse the heat transfer in various mechanical components.

OBJECTIVES:
- Explain the components of IC engines.
- Explain the performance tests on IC engines.
- Explain the fundamental of thermal power plant and steam turbines and condensers..
- Explain the refrigeration and air conditioning.
- Compare the modes of heat transfer and evaluate the heat transfer by various modes.
- Explain the Conventional Sources Of Energy And Nuclear Power Plant.

THERMAL ENGINEERING
DETAILED SYLLABUS

Unit-I (14)
INTERNAL COMBUSTION ENGINES
Internal combustion engines - Classification of I.C Engines-Components of I.C Engines and functions, materials and method of manufacturing- four stroke petrol and diesel engines – two stroke petrol and diesel engines – Comparison of four stroke and two stroke engines - Comparison of petrol and diesel engines – Valve timing diagram for four stroke Petrol and Diesel Engines – Port timing diagram for two stroke petrol and diesel engines. Layout of fuel supply system in petrol engines – A.C Mechanical fuel pump – Simple Carburetor – Layout of fuel supply system in diesel engine - Single acting fuel feed pump – CAV fuel injection pump – fuel injectors – Types of Nozzles - fuel filters. Ignitions systems – Battery coil ignition system-Magneto ignition system – Governing of IC Engines - Quantity and Quality Governing. Cooling systems – Air cooling – Water cooling. Lubrication system – Properties of lubricants – Types of lubrication systems- Petroil and high pressure lubrication system – Oil pump (Gear & Rotor Pumps) and Oil filters.

Unit-II (14)
PERFORMANCE OF I.C ENGINES AND HEAT TRANSFER
Testing – thermodynamic and commercial tests – indicated power – brake power – friction power – efficiencies of I.C engines – indicated thermal, brake thermal, mechanical and relative efficiencies – Specific fuel consumption – problems. Morse test – procedure – problems – heat balance sheet – problems. Modes of heat transfer – heat transfer by conduction – Fourier's law – Thermal conductivity – heat conduction through plane and composite walls – heat conduction through a cylinder – simple problems – heat transfer by convection – heat exchanger – Parallel flow and counter flow – LMTD – forced convection – natural convection – heat transfer by radiation – Radioactive properties – definitions of black, white, opaque, transparent & grey bodies.

Unit-III (14)
THERMAL POWER PLANT AND STEAM TURBINES AND CONDENSERS
Selection of site for thermal power plant – layout of thermal power plant - fuel and ash circuit-water and steam circuit - air and flue gas circuit - cooling water circuit -merits and demerits of thermal power plant - air pollution by thermal power plants-pollutants, effects and control - cyclone separator - wet scrubber-electrostatic precipitator - control of No2 and SO. Fluidised bed combustion -thermal and noise pollution. Basic steam power cycles- Carnot, Rankine and modified Rankine cycles - classification of

steam turbine - Impulse and reaction turbines – Difference - necessity of compounding - Methods of compounding-special turbines. Steam condensers - elements of condensing plant - classification of condensers - jet condenser – types - surface condensers – types - Comparison of jet and surface condensers - sources of air in condenser - condenser vacuum-vacuum efficiency - condenser efficiency - Dalton's law- mass of cooling water required - mass of air present - number of tubes – problems - Cooling Towers.

Unit-IV   **(13)**
REFRIGERATION AND AIR CONDITIONING
Refrigeration – refrigerators and heat pumps – types and applications of refrigeration systems – refrigerating effect – unit of refrigeration – C.O.P – actual C.O.P – Air refrigeration system – reversed carnot cycle – C.O.P of refrigerator, heat pump & Heat engines – Power required – Mass of ice produced – problems – Bell-Coleman cycle – problems – Vapour compression refrigeration system – Vapour absorption system – Comparison – Refrigerants – desirable properties. Psychometry – psychometric properties – dry air – moist air – water vapour – saturated air – dry bulb temperature – wet bulb temperature – wet bulb depression – dew point temperature – dew point depression – humidity – specific and relative humidity – psychometric chart – psychometric processes – sensible heating and cooling – By pass factor – humidification – dehumidification – Mixing of Air stream – simple problems using psychometric chart – air conditioning – classification and applications of air conditioning system – room air conditioning – central air conditioning – comparison – comfort and industrial air conditioning – factors to be considered in air conditioning – loads encountered in air conditioning systems.

Unit-V   **(13)**
CONVENTIONAL SOURCES OF ENERGY AND NUCLEAR POWER PLANT
Conventional sources of energy – Layout of hydel and diesel power plants – Merits and demerits. Nuclear fuels – fissile and fertile fuels – Nuclear fission and fusion – Chain reaction – Radioactivity – Layout of nuclear power plant – Merits and demerits – Nuclear reactor – components – Reactor core – Moderators – Control rods – Coolant – Reflectors - Biological shield – Reactor vessels – Classification of Reactor – Pressurized water reactor – effect of nuclear radiation – Fuel cycle – Site selection – Safety – floating nuclear power plants – Uranium enrichment – Methods – Disposal of nuclear wastes – Comparison of Nuclear power plants with thermal power plants – Nuclear Power plants in India.

Text Books:
1. Thermal Engg, R.K. Rajput, 8th Edition, Laxmi Publications pvt Ltd, New Delhi.
2. Thermal Engineering, R.S.Khurmi and J.K. Gupta, 18th Ed., S.Chand & Co, New Delhi.
3. Power Plant Engineering, G.R. Nagpal, Khanna Publishers, New Delhi.
4. Refrigeration and Air Conditioning, P.L. Ballaney, 4th Edition, Khanna Publishers, New Delhi.

Reference Books:
1. Thermal Engineering, P.L Ballaney, 24th Edition, Khanna Publishers, NewDelhi.
2. Thermal Engineering, B.K. Sarkar, 3rd Edition, Dhanpat Rai & Sons, NewDelhi.
3. Power Plant Engineering Thermodynamics, Domkundwar and C.P.Kothandaraman, 2nd Edition, Khanna Publishers.
4. Refrigeration and Air Conditioning, Manohar Prasad.
5. Power Plant Engineering, P.C.Sharma, S.K. Kataria & Sons, New Delhi.

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name	:	DIPLOMA IN MECHANICAL ENGINEERING
Course Code	:	
Subject Code	:	M-533
Semester	:	V
Subject Title	:	**PROCESS PLANNING AND COST ESTIMATION**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination				
	Hours / Week	**Hours / Semester**	**Marks**				**Duration**
PROCESS PLANNING AND COST ESTIMATION			**Internal Assessment**	**Board Examination**	**Total**		
	5	75					3 Hrs
			25	75	100		

Topics and Allocation of Hours:

Unit No	Topics	Hours
I	PROCESS PLANNING	14
II	PROCESS SELECTION	14
III	WORK STUDY	14
IV	COST ESTIMATION	13
V	MACHINING TIME CALCULATIONS	13
	TEST AND REVISION	7
	TOTAL	**75**

RATIONALE:

RATIONALE:

In the product manufacturing the process selection and planning are important. In this subject the work study, cost estimation and machining time calculations are discussed.

OBJECTIVES:

- Understand the process planning.
- Study the process selection.
- Understand the work study and method study.
- Study the cost estimation.
- Study the machining time calculations.

PROCESS PLANNING AND COST ESTIMATION
DETAILED SYLLABUS

UNIT I (14)
Process Planning
Introduction - concept – Information required to do processplanning - factors affecting process planning - process planningprocedure - Make (or) Buy decision using Break Even Analysis -simple problems. Manual process planning - Introduction ofAutomatedprocess planning and generator process planning - Advantageof computer aided process planning – Principle of line balancing-need for line balancing –Value Engineering–Definition - cost control Vs cost reduction -value analysis when todo - steps information needed - selection of product.

UNIT II (14)
Process Selection
Processselection -technological choice- specific componentchoice - Process flow choice – Factors affecting process selection- machine capacity – analysis of machine capacity - process andequipment selection procedure - Determination of man, machineand material requirements - simpleproblems - selection ofmaterial – jigs - fixtures etc. - Factorsinfluencing choiceOfmachinery – selectionofmachinery – simpleproblems-preparation of operation planning sheet for simple components.

UNIT III (14)
Work Study
Objectives of work study - Concept of work content – Techniques to reduce work content - method study – Procedure – Recording techniques used in method study - Micro motion study - Principles of motion economy - Therbligs - Simo chart - cycle graph - Chrono cycle graph - work measurement - Basic Procedures for the conduct of time study - calculation of standard time - simple problems – Ergonomics – definition – objectives – applications - working environment - work place layout - other areas.

UNIT IV (13)
Cost Estimation
Introduction - Definition - Purpose of cost estimation - costestimation Vs Cost accounting - components of cost – direct cost -indirect cost - overhead expenses - estimation of cost elements -set up time and economic lot size - tool change time – Inspectiontime - performance factor – overheads - different methods ofapportioning overheads – Data required for cost estimating-Steps in making a cost estimate – problems - estimation ofproduction cost of simple components such as coupling, shaft, crank etc. – problems.

UNIT V **(13)**

Machining Time Calculations

Elements of metal machining - cutting speed - feed - depth of cut - procedure for assigning cutting variables - calculation of machining time for different lathe operations like - turning - facing - chamfering - parting - knurling and forming - Calculation of machining time for operations on drilling machine - machining time for shaping, planing, slotting, broaching and sawing operations - Machining time for face milling and slab milling operations - timing for thread cutting - estimation of total unit time - Procedure for doing the above machining calculations with formulae used - simple problems.

TEXT BOOKS:
1. Industrial Engineering & Management - O.P Khanna
2. Industrial Engineering & Production Management - Martand Telsang

REFERENCE BOOKS:
1. Production Engineering - P.C.Shrma.
2. Production and Costing - GBS Narang and V.Kumar
3. Mechanical Estimating and Costing - Banga & Sharma.

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name	:	DIPLOMA IN MECHANICAL ENGINEERING
Subject Code	:	M-5541
Semester	:	V
Subject Title	:	**RENEWABLE ENERGY SOURCES AND ENERGY CONSERVATION**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination				Duration
RENEWABLE ENERGY SOURCES AND ENERGY CONSERVATION	Hours / Week	Hours / Semester	Marks				Duration
	5	75	Internal Assessment	Board Examination	Total		3 Hrs
			25	75	100		

Topics and Allocation of Hours:

Unit No	Topics	Hours
I	FUNDAMENTALS OF ENERGY, WIND ENERGY	14
II	SOLAR ENERGY,APPLICATION,STORAGE	14
III	SOLARPHOTOVOLTAICSYSTEMANDDESIGN,OCEN,TIDAL,WAVE ENERGY	14
IV	BIO-ENERGY	13
V	ENERGY CONSERVATION TECHNIQUES AND ENERGYAUDIT	13
	TEST AND REVISION	7
	TOTAL	**75**

RATIONALE:

Electrical Energy requirement is the major crisis and hence any saving in Electrical energy is equivalent to production of Electrical Energy. Saving can be achieved by the utilization of Renewable Energy Sources.

OBJECTIVES:
- Study about the fundamentals of Energy.
- Study of construction and principle of Wind energy, Solar energy, Tidal energy and Bio energy.
- Understand the PV design and its components.
- Understand the energy management and auditing techniques.
- Study the energy conservation process.

RENEWABLE ENERGY SOURCES AND ENERGY CONSERVATION
DETAILED SYLLABUS

UNIT I (14)
FUNDAMENTALS OF ENERGY
Introduction to Energy-Energy consumption and standard of living-classification of energy resources-consumption trend of primary energy resources-importance of renewable energy sources- energy for sustainable development.

WIND ENERGY
Introduction-Basic principles of wind energy conversion: Nature of the wind, power in the wind, forces on the blades and wind energy conversion-wind data and energy estimation-site selection-classification of wind energy conversion systems- components of conversion systems-Advantages and Disadvantages-Types of wind machines-Horizontal axis machine-Vertical axis machine-Generating system-Energy Storage–Application of wind energy-Safety and environmental aspects.

UNIT II (14)
SOLAR ENERGY
Introduction – Solar radiation at the earth's surface-Solar Radiationmeasurements-Estimation of average solar Radiation.
Solar energy collectors- Classifications-Flat plate collectors -Concentrating collectors-performance parameter-tracking system-compound parabolic concentrator-parabolic trough concentrators-concentrator with point focus-heliostats-comparisons of variouscollectors-efficiency of collector-selection of collector for variousapplications.
Solar Thermal Application: Solar water heaters-Solar industrialheating system – Solar Refrigeration and Air-Conditioning Systems-Solar cookers-Solar furnaces-Solar greenhouse-Solar Distillation- Solar pond Electric power plant Distributed Collector- Solar thermalElectric power plant.
Solar thermal energy storage: sensible storage-latent heatstorage-thermo chemical storage.

UNIT III (14)
Solar photovoltaic System and Design
Solar photovoltaic a brief history of PV,PV insilicon: basicprinciple, crystalline PV; reducing cost and raising efficiency, thin filmPV, other innovative technologies, electrical characteristics of siliconPV cells and modules, grid connected PV system, cost of energyfrom PV ,Environmental impact and safety.System design of solar photovoltaic system: Load analysis-solararray Design-Battery Design-Simple formulas. System designprocedure. Case Studies: Designing solar home lighting system - Designing stand alone solar PV Power plant - Designing solar PVwater pumping system - Only arriving load capacity - solar arraysizing - Battery sizing - Inverter capacity and mountings.
Ocean energy, Tidal & Wave energy

Ocean energy resources – principle's of ocean thermal energyconversion (OTEC) – Methods of Ocean thermal electric powergeneration – Energy utilization – basic principle of tidal power – components and operations of tidal power plant – Energy and Powerforms of waves – Wave energy conversion devices.

UNIT IV (13)
BIO – ENERGY
Introduction – photo synthesis – usable forms of bio mass, theircomposition and fuel properties-Biomass resources – Biomassconversion technologies – Urban waste to energy conversion –
Biomass gasification – biomass liquification – biomass to ethanolproduction – Biogas production from waste Biomass – types of biogas plants - applications – Bio diesel production – Biomass energyprogramme in India.

UNIT V
(13)Energy Management and Audit, Conservation: Definition, Energy
audit - need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments
Energy Conservation Techniques- Need and importance of energy conservation -Principles of energy conservation- Methods of energy conservation-Cogeneration and its application-Combined cycle system-Concept of energy management-Study of different energy management techniques like-Analysis of input-Reuse and recycling of waste.
Economic approach of Energy Conservation-Costing of utlities like steam, compressed air, electricity and water-Ways of improving boiler efficiency-Thermal insulation, Critical thickness of insulation-Waste heat recovery systems, their applications, criteria for installing unit-An introductory approach of energy conservation in compressed air, refrigeration, air conditioning, pumps and fans.

Text Books:
1. Non Conventional Energy Sources - G.D. Rai – Khanna Publishers, New Delhi,1999.
2. Non Conventional Energy Sources and Utilisation - R.K. Rajput - S.Chand & Company Ltd., 2012.
3. Renewable Energy Sources - Twidell, J.W. and Weir, A. - EFN Spon Ltd., 1986.
4. Non-Conventional Energy Resources - B.H.Khan - Tata Mc Graw Hill, 2nd Edn, 2009.
5. Industrial energy conservation- D. A. Ray- Pergaman Press
6. Energy resource management- Kirpal Singh Jogi- Sarup and sons

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name	:	DIPLOMA IN MECHANICAL ENGINEERING
Course Code	:	
Subject Code	:	M-5542
Semester	:	V
Subject Title	:	**TOTAL QUALITY MANAGEMENT**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination				
	Hours / Week	Hours / Semester	Marks				Duration
TOTAL QUALITY MANAGEMENT	5	75	Internal Assessment	Board Examination	Total		3 Hrs
			25	75	100		

Topics and Allocation of Hours:

Unit No	Topics	Hours
I	BASIC CONCEPTS OF TOTAL QUALITY MANAGEMENT	14
II	CONTINUOUS PROCESS IMPROVEMENT – Q-7 TOOLS	14
III	STATISTICAL FUNDAMENTALS	14
IV	CONTROL CHARTS	13
V	MANAGEMENT PLANNING TOOLS & BENCH MARKING	13
	TEST AND REVISION	7
	TOTAL	**75**

RATIONALE:

Quality and customer satisfaction in every product and every activity is the order of the day. As there is a shift from quality control to quality management in all activities, the concept Total Quality Management and the pillars of TQM are to be given to Engineers, who are designing products and production systems.

OBJECTIVES
- Define quality and appreciate its signature.
- Explain the concept of TQM.
- Appreciate the use of principles of TQM to meet customer satisfaction.
- Solve problem using the Quality control tools.
- Apply Brainstorming and quality circle to solve problems.
- Use PDCA cycle for continuous improvement.
- Appreciate the benefits of implementing 5S concepts.
- Collect, classify and present the data.
- Determine the process capability of a manufacturing process.
- Practice on management planning tools.
- Use Bench Mark and JIT concepts.

TOTAL QUALITY MANAGEMENT
DETAILED SYLLABUS

UNIT I (14)

BASIC CONCEPTS OF TOTAL QUALITY MANAGEMENT

Quality-Definitions - Dimensions of quality - Brainstorming and itsobjectives - Introduction to TQM – Characteristics – Basic concepts– Elements – Pillars – Principles - Obstacles to TQMimplementation – Potential benefits of TQM – Quality council –Duties – Responsibilities – Quality statements – Vision – Mission –Quality policy statements – Strategic planning – Seven steps tostrategic planning – Deming philosophy- Customer delight – ISO9001:2008 Quality Management System requirements andimplementation.

UNIT II (14)

CONTINUOUS PROCESS IMPROVEMENT – Q7 TOOLS

Input / Output process model – Juran Trilogy – PDCA (DemingWheel) cycle – 5S Concepts – SEIRI, SEITON, SEISO, SEIKETSU and SHITSUKE – needs and objectives – effective implementation of 5S concepts in an organisation - Housekeeping – Kaizen.

Seven tools of quality control (Q-7 tools) – Check sheet – Types ofcheck sheet – Histogram – Cause and effect diagram - Paretodiagram – Stratification Analysis – Scatter diagram-Graph/runcharts – Control charts - Construction of above diagrams.

Quality circle - concept of quality circle - Organisation of Quality circle and objectives of Quality circle.

UNIT III (14)

STATISTICAL FUNDAMENTALS

Types of Data – Collection of Data – Classification of Data –Tabular presentation of Data – Graphical representation of a frequency distribution – Comparison of Frequency distribution – Mean – Median – Mode – Comparison of measures of centraltendency – Introduction to measures of dispersion – Sample –sampling - Normal curve – Sigma – Concept of six sigma – Principles – Process- Problems.

UNIT IV **(13)**
CONTROL CHARTS
Control chart – Types of control charts – Control chart for variables– Construction of X and R charts – control limits Vs specificationlimits – Process capability – Method of doing process capabilityAnalysis – Measures of process capability – Problems.
Attributes – Control charts – P chart – np chart – c chart – u chart –Construction of above diagrams – Problems - Comparison betweenvariable chart and Attribute chart.

UNIT V **(13)**
MANAGEMENT PLANNING TOOLS & BENCH MARKING
Affinity diagram – Radar Diagram - Inter Relationship diagram (InterRelationship diagram) – Tree diagram - Prioritization matrix – Matrix diagram – Decision tree – Arrow diagram – Matrix data analysis diagram - Construction of above diagrams.

Bench marking – Objectives of bench marking – Types – Bench marking process - Benefits of Bench marking – Pit falls of Bench marking-Just In Time(JIT) concepts and its objectives - Total Productive Maintenance(TPM) - Introduction, Objectives of TPM - steps in implementing TPM.

Text Book:
1. Total Quality Management, Date H.Besterfiled, Pearson Education Asia.
2. Total Quality Management, V.Jayakumar, Lakshmi Publications.(reprint 2005)
3. Training manual on ISO 9001 : 2000 & TQM, Girdhar J.Gyani, Raj Publishing House, Second Edition 2001
4. Quality Management, Howard Cuitlow, Tata Mc Graw Hill, 1998

Reference Book:
1. Total Quality Management, Oakiand.J.S. Butterworth Heinemann Ltd. Oxford 1989.
2. Quality Management – Concepts and Tasks- Narayana.V and Sreenivasan.N.S., New Age International 1996.
3. Total Quality Management for engineers, Zeiri. Wood Head Publishers. 1991.
4. Quality Planning and Analysis, Juran J.M and Frank M.Gryna Jr., TMH. India. 1982
5. ISO 9001, Brain Rethry, Productivity and Quality Publishing Pvt. Ltd. 1993.
6. Quality Auditing D.Mills, Chapman and Hall, 1993.

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name	:	DIPLOMA IN MECHANICAL ENGINEERING
Course Code	:	
Subject Code	:	M-5543
Semester	:	V
Subject Title	:	**PRESS TOOLS**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
PRESS TOOLS	5	75	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

Topics and Allocation of Hours:

Unit No	Topics	Hours
I	PRESS WORKING FUNDAMENTALS, OPERATIONS, AND MACHINERY	14
II	PRESS & PRESS TOOL ACCESSORIES AND CUTTING DIES	14
III	BENDING AND FORMING DIES	14
IV	DRAWING DIES AND DIES FOR SECONDARY OPERATIONS	13
V	FINE BLANKING TOOL AND SPECIALIZED PRESS TOOL APPLICATIONS	13
	TEST AND REVISION	7
	TOTAL	**75**

RATIONALE:

Press working plays a vital role in the metal forming process. The study about the operations in the press work is important method of manufacturing.

OBJECTIVE
- Explain the fundamentals of press working, to be familiar with the various press working operations and machines.
- Appreciate the safety practices in press working operations.
- Explain with the various press and press tool accessories
- Compare the different types of Die construction.
- Explain the various bending, forming and other miscellaneous press working operations.
- Demonstrate about the construction and operation of the different bending dies.
- Define the various drawing and other related processes
- Explain the construction and operating principle of drawing and combination dies.
- Explain the basic concepts and the advantages of fine blanking process
- Demonstrate the construction and working principle of various fine blanking dies.
- Appreciate the concepts of SMED and quick die changes and its advantages in bringing down the press set up time.
- Troubleshoot in various press tools.

PRESS TOOLS
DETAILED SYLLABUS

UNIT I (14)
PRESS WORKING FUNDAMENTALS, OPERATIONS, AND MACHINERY
Shearing Theory-Critical stages of shearing, Features of a punched hole, features of the slug, burr. Clearance - Effects of Optimum, Excessive and Insufficient clearances, Clearance for blanking and Piercing, Land and Angular Clearance. Cutting Force – Methods to reduce cutting force, stripping force.Press working operations - Blanking, Piercing, Cutting off, Parting off, perforating, embossing, coining, bending, forming, drawing, curling, bulging, extrusion, swaging, trimming, and shaving. Safety in press working.
Presses - Common types of Presses, Main parts of a typical power press, OBI Press, Specification of presses, Comparison ofMechanical, hydraulic and Pneumatic presses. Single action, double action and triple action pressesPress operating parameters – Tonnage, shut height, stroke, shut height adjustment, strokes per minute, die space. Special purpose presses – Press brake, transfer press, multi slide machine.

UNIT II (14)
PRESS & PRESS TOOL ACCESSORIES AND CUTTING DIES
Press Feeding Mechanisms - Uncoilers, Straighteners and recoilers, Hand feed, hitch/grip feed, Roll feed, Hopper feeds, dial feeds, chutes, slides, magazine feeds. Ejection mechanism – Ejection by Gravity, air ejection, mechanicalejection, semi automatic and automatic ejection, Mechanical hands,ejection by next part.
Parts and functions of a press tool - Punches, Dies, Stoppers, Trigger stops, Strippers – Fixed and Travelling, Gauges, Pilots-Methods of piloting, shanks -Strip layout, Economy factor.

Cutting Dies - Construction and working of Blanking tool, Piercing tool, Progressive tool, Compound tool. Commercially available die components – Die sets, die set attachment devices, punches, die buttons, retainers, springs, fluid springs, die cushion and its types.

UNIT III (14)
BENDING AND FORMING DIES:

Bending of sheet metal – Bending theory, neutral axis, metal movement, spring back, methods of overcoming spring back. Bending Operations – Bending, flanging, hemming, curling, seaming, and corrugating. Types of Bending dies (construction and workingprinciple) – V bending and its types, edge bending, U bending.

Bending operations done using press brake. Forming dies – Construction and working principle of solid form dies,pad form dies, curling dies, embossing dies, coining dies, swaging dies, bulging dies, crimping, tube forming. Assembly dies - Riveting, tab stake, upset stake, crimping.

UNIT IV (13)
DRAWING DIES AND DIES FOR SECONDARY OPERATIONS

Drawing operations – Shallow drawing, deep drawing. Analysis of cup drawing - Stages of drawing. Variables of drawing - Bending and straightening variables, friction variables, compression variables, stretch forming variables, analysis of draw speed. Draw dies & its construction and working principle – Conventional draw die, inverteddraw die, redrawing and reverse drawing dies, drawing of square or rectangular shapes. Blank holders, blank holding pressure and its importance, air vents, drawing inserts, draw beads. Drawing with flexible tooling – Marform process, Hydro form process. Drawing defects, causes and remedies.

Dies for secondary operations - Construction and working principle of Semi piercing dies, shear form dies, dies for formed contours, notching die, shaving die, side piercing die.

UNIT V (13)
FINE BLANKING TOOL AND SPECIALISED PRESS TOOL APPLICATIONS

Fine blanking - Definition and Applications of fine blanking, Working principle of fine blanking tool, V Ring, function of V ring. Comparison of fine blanking with blanking. Clearance and press force calculations. Fine Blanking Machines - Working principle, Ram movement, Mechanical drives, hydraulic drives, Machine force, Ring indenter force, counter force. Fine blanking tools - Compound die tooling system with sliding punch, compound die tooling with fixed punch.

Specialized Press Tool Applications - Construction, advantage and applications of advanced multistage tooling, unit tooling, angular piercing tools, CNC turret press. Principle of Quick Die Change (QDC) – need and advantages. Single Minute Exchange of Dies (SMED) – concept need and advantages. Factors Affecting Tool Service Life - Introduction, Elements of Tool performance, Procedure for investigation of tool failure, Trouble shooting in press tools, effect of heat treatment on service life of tools.

Text Books:
1. Donald F. Eary. & Edward A. Reed, "Techniques of Press working sheet metal", Prentice-Hall,Inc.,
2. Donaldson, "Tool Design", Tata McGraw-hill Book Company.
3. Eugene ostergaard.D, "Advanced die making", McGraw-Hill Book Company.

Reference Books:
1. Dr.John G.Nee, "Fundamentals of Tool Design", Society of Manufacturing Engineers.
2. ASTME, "Tool Engineers Hand Book", McGraw-hill Book Company. .

3. Paquin.J.R, "Die design fundamentals", Industrial Press Inc,.
4. Eugene ostergaard.D, "Basic die making", McGraw-hill Book company,.
5. Ivana Suchy, "Hand book of Die Design", McGraw-Hill Book company.
6. American Society of Metals – Hand book – Volume 4 (Forming)

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name	:	DIPLOMA IN MECHANICAL ENGINEERING
Course Code	:	
Subject Code	:	M-555
Semester	:	V
Subject Title	:	**PROCESS AUTOMATION PRACTICAL**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination			
PROCESS AUTOMATION PRACTICAL	**Hours / Week**	**Hours / Semester**	**Marks**			**Duration**
	4	60	**Internal Assessment**	**Board Examination**	**Total**	3 Hrs
			25	75	100	

OBJCETIVES

- Design and operate pneumatic circuits.
- Design and operate fluid power circuits
- Use PLC system and its elements for process control
- Familiarize the working of function blocks in PLC
- Use ON-Delay timer to control a motor
- Use OFF-Delay timer to control a motor
- Use counter function block (Up counter and Down counter)
- Control the automatic operation of pneumatic cylinder using PLC
- Record of work to be prepared.

Exercises

Pneumatics Lab
1. Direct operation of single and double acting cylinder.
2. Operation of double acting cylinder with quick exhaust valve.
3. Speed control of double acting cylinder using metering-in and metering-out circuits.
4. Automatic operation of double acting cylinder in single cycle - using limit switch.
5. Automatic operation of double acting cylinder in multi cycle - using limit switch.

Hydraulics Lab
6. Direct operation of double acting cylinder.
7. Direct operation of hydraulic motor.
8. Speed control of double acting cylinder metering-in and metering-out control.

PLC Lab
9. Direct operation of a motor using latching circuit.
10. Operation of a motor using 'AND' logic control.
11. Operation of a motor using 'OR' 'control.
12. On-Delay control of a motor and Off –Delay control of a motor.
13. Automatic operation of a Double acting cylinder-single cycle.
14. Automatic operation of a Double acting cylinder-single cycle - forward, time delay, return.
15. Automatic operation of Double acting cylinder-Multi cycle.
16. Sequential operation of double acting cylinder and a motor.

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M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

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Course Name	:	DIPLOMA IN MECHANICAL ENGINEERING
Course Code	:	
Subject Code	:	M-556
Semester	:	V
Subject Title	:	**THERMAL ENGINEERING PRACTICAL**

TEACHING AND SCHEME OF EXAMINATIONS:

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No. of weeks per semester: 15 Weeks

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Subject	Instructions		Examination				
THERMAL ENGINEERING PRACTICAL	**Hours / Week**	**Hours / Semester**	**Marks**				**Duration**
	4	60	**Internal Assessment**	**Board Examination**	**Total**		3 Hrs
			25	75	100		

OBJECTIVES:

- Determine the flash and fire point and viscosity of oil.
- Draw the valve timing diagram of petrol and diesel engines.
- Draw the port timing diagram of petrol and diesel engines.
- Conduct performance test on petrol and diesel engines.
- Prepare heat balance sheet for an IC engine.
- Identify the parts of a high pressure boiler and their applications.
- Identify the boiler mountings and accessories and their functions.
- Determine the C.O.P of Refrigerators.

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Study Exercise:

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1. Study of high pressure boiler. (With model)
2. Study of boiler mountings and Accessories. (With model)

LIST OF EXPERIMENTS
PART – A
1. Determine flash and fire point of the given oil using open cup apparatus.
2. Determine flash and fire point of the given oil using closed cup apparatus.
3. Determine the absolute viscosity of the given lubricating oil using Redwood viscometer.
4. Determine the absolute viscosity of the given lubricating oil using Say bolt viscometer.
5. Port timing diagram of two stroke petrol engine.
6. Valve timing diagram for four stroke petrol engine.
7. Valve timing diagram for four stroke diesel engine.

PART – B
1. Load test (Performance test) on Four Stroke Petrol Engine.
2. Load test (Performance test) on Four Stroke Diesel Engine.
3. Morse test on Multi-cylinder petrol engine.
4. Heat balance test on Four Stroke Petrol engine.
5. Heat balance test on four stroke diesel engine.
6. Volumetric efficiency of Air Compressor.
7. Thermal Conductivity measurement using guarded plate apparatus.
8. Determination of COP of Refrigeration System.

(Implements from the Academic year 2015-2016 onwards)

Course Name	:	DIPLOMA IN MECHANICAL ENGINEERING
Course Code	:	
Subject Code	:	M-557
Semester	:	V
Subject Title	:	**LIFE AND EMPLOYABILITY SKILLS PRACTICAL**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination				Duration
LIFE AND EMPLOYABILITY SKILLS PRACTICAL	**Hours / Week**	**Hours / Semester**	**Marks**				**Duration**
			Internal Assessment	**Board Examination**	**Total**		3 Hrs
	4	60	25	75	100		

Allocation of marks

Sl. No.	Section	No. of Hours
1	**Part – A** Communication	**30**
2	**Part – B** Entrepreneurship, Project Preparation Productivity, Occupational Safety, Health, Hazard, Quality Tools & Labour Welfare	**20**
3	**Part – C** Environment, Global Warming, Pollution	**10**
TOTAL		**60**

RATIONALE:

Against the backdrop of the needs of the Industries, as wells as based on fulfilling the expectations of the Industries, the Diploma Level students have to be trained directly and indirectly in toning up their competency levels. Proficiency in Communication only, equips them with confidence and capacity to

cope with the employment. Hence, there is a necessity to focus on these in the curriculum. At the end of the Course, the student is better equipped to express himself in oral and written communication effectively.

SPECIFIC INSTRUCTIONAL OBJECTIVES
- **Emphasize and Enhance Speaking Skills**
- **Increase Ability to Express Views & Opinions**
- **Develop and Enhance Employability Skills**
- **Induce Entrepreneurship and Plan for the Future**
- **Expose & Induce Life Skills for Effective Managerial Ability**

M 447 - LIFE AND EMPLOYABILITY SKILLS LAB

Unit	Topics	Activities	Hours
I	**Communication, Listening, Training, Facing Interviews, Behavioural Skills**	-- instant sentence making -- say expressions/phrases -- self- introduction / another higher official in company	**30**
II	**Entrepreneurship, Project Preparation, Marketing Analysis, Support & Procurement**	-- prepare an outline of a project to obtain loan from bank in becoming an entrepreneur -- prepare a resume	**10**
III	**Productivity – comparison with developed countries, Quality Tools, Circles, Consciousness, Management, House Keeping**	-- search in the website -- prepare a presentation -- discuss & interact	**05**
IV	**Occupational Safety, Health Hazard, Accident & Safety, First-Aid, Labour Welfare Legislation, Welfare Acts**	-- search in the website -- prepare a presentation -- discuss & interact	**05**
V	**Environment, Global Warming, Pollution**	-- taking down notes / hints -- answering questions -- fill in blanks the exact words heard	**10**

LEARNING STRUCTURE   **100 Marks**
-- **Focus more on Speaking & Listening Skills**
-- **Attention less on Reading & Writing Skills**
-- **Apply the skills in fulfilling the Objectives on Focused Topics**
--

a) Listening   **25 Marks**
1.   Deductive Reasoning Skills (taking down notes/hints)   **10**
2.   Cognitive Skills (answering questions)   **10**
3.   Retention Skills (filling in blanks with exact words heard) **05**

b) Speaking Extempore/ Prepared   **30 Marks**
1. Personality/Psychological Skills (instant sentence making)   **05**
2. Pleasing & Amiable Skills (say in phrases/expressions)   **05**
3. Assertive Skills (introducing oneself/others)   **05**
4. Expressive Skills (describe/explain things)   **05**
5. Fluency/Compatibility Skills (dialogue)   **05**
6. Leadership/Team Spirit Skills (group discussion)   **05**

c) Writing & Reading   **20 Marks**
1. Creative & Reasoning Skills (frame questions on patterns)   **05**
2. Creative & Composing Skills (make sentences on patterns)   **05**
3. Attitude & Aim Skills (prepare resume)   **05**
4. Entrepreneurship Skills (prepare outline of a project)   **05**

d) Continuous Assessment (Internal Marks)   **25 Marks**
   (search, read, write down, speak, listen, interact & discuss)
1. Cognitive Skills (Google search on focused topics)
2. Presentation Skills & Interactive Skills (after listening, discuss)

Note down and present in the Record Note on any 5 topics   **10 Marks**
Other activities recorded in the Record note   **10 Marks**
Attendance   **05 Marks**
                                 ———————

INTERNAL MARKS   **25 Marks**

EXTERNAL MARKS AT END EXAMINATION   **75 Marks**

<u>**MODEL QUESTION**</u>
Time: 3 Hours   **Max. Marks: 75**
A. LISTENING   **25 Marks**
1. Listen to the content and take down notes/hints   10
2. Listen to the content and answer the following questions.   10
3. Listen to the content and fill in the blanks the exact words heard.   05

B. SPEAKING   **30 Marks**
1. Say in a sentence instantly on hearing the word (5 words, one after another).   05
2. Say any five expressions commonly used in communication.   05
3. Imagine, a consultant has come to your department. Introduce him to your subordinates.05
4. Explain/describe the product you are about to launch in the market.   05
5. Speak with your immediate boss about the progress you have made.   05
6. Discuss within the group on the topic of focus in the syllabus.   05

C. WRITING & READING   **20 Marks**
1. Frame new questions from the pattern given by changing sets of words with your own.   05

a.	When	Do	you	return?
b.	How	Is	his performance?	
c.	Where	Has	the manager	gone?
d.	What	Is	the progress	today?
e.	Why	Are	the machines	not functioning?

2. Make sentences from the pattern given by changing sets of words with your own.   05

a.	The workers	are	on strike		
b.	The labourers	are paid	well	in this factory	
c.	There	is	a rest room	for the workers	
d.	These	are	the new products	launched	by our company
e.	Almost everyone	come	to the company	on motorbikes	

3. Prepare a resume for the post of Department Manager.   5
4. Prepare an outline of a project to obtain a loan. (Provide headings and subheadings) 05

Guidelines for setting the question paper

A. LISTENING:
ONLY TOPICS related to POLLUTION / ENVIRONMENT / GLOBAL WARMING are to be taken. These topics are common for all the three types of evaluation.

B. SPEAKING:
✓ WORDS of common usage
✓ Fragments – expression of politeness, courtesy, cordiality
✓ Introduce yourself as an engineer with designation or Introduce the official visiting your company/department
✓ Describe/Explain the product/machine/department
✓ Dialogue must be with someone in the place of work.
✓ Group of six/eight
✓ Discuss the focused topic prescribed in syllabus

C. WRITING & READING:
• Provide five different structures.
• Students are to substitute at least one with some other word/words
• Provide five different structures.
• Students are to substitute at least one with some other word/words
• Provide some post related to industries.
• Outline of the project (skeleton/structure)
• Only the various headings and subheadings
• Content is not needed

Guidelines for recording the material on the Focused Topics in the Record note.

Write in the record note, **on any five topics**, from the list of topics given below. **10 Marks**
(5 topics x 10 marks = 50 marks. Thus, the **Average of 5 topics is 10 Marks)**

1. Productivity in Industries – Comparison with developed countries
2. Quality Tools, Quality Circles and Quality Consciousness
3. Effective Management
4. House Keeping in Industries
5. Occupational Safety and Hazard
6. Occupational Accident and First Aid
7. Labour Welfare Legislations
8. Labour Welfare Acts and Rights
9. Entrepreneurship
10. Marketing Analysis, Support and Procurement

LABORATORY REQUIREMENT:
1. An echo-free room
2. Necessary furniture and comfortable chairs
3. A minimum of two Computers with internet access
4. A minimum of two different English dailies
5. A minimum of Three Mikes with and without cords
6. Colour Television (minimum size – 29")
7. DVD/VCD Player with Home Theatre speakers
8. Smart board
9. Projector

Suggested Reading:
1. Production and Operations Management by S.N. Chary, TMH
2. Essentials of Management by Koontz &Weihrich, TMH
3. Modern Production / Operations Management by E.S. Buffa and R.K. Sarin, John Wiley & Sons
4. Production Systems: Planning, Analysis and Control by J.L.Riggs, 3rd ed., Wiley.
5. Productions and Operations Management by A.Muhlemann, J.Oakland and K.Lockyer, Macmillan
6. Operations Research - An Introduction by H.A.Taha, Prentice Hall of India
7. Operations Research by J.K.Sharma, Macmillan
8. Business Correspondence & Report Writing by R.C. Sharma and K.Mohan, TMH
9. How to prepare for Group Discussion & Interview (With Audio Cassette) by Prasad, TMH
10. Spoken English – A self-learning guide to conversation practice (with Cassette)
11. Introduction to Environmental Engineering by Mackenzie, L. Davis and A. David, Cornwell, McgrawHill, 3rd Ed.
12. Environmental Engineering by Peary, Rowe and Tchobanoglous, McgrawHill
13. Total Quality Management – An Introductory Text by Paul James, Prentice Hall
14. Quality Control and Applications by Housen&Ghose
15. Industrial Engineering Management by O.P. Khanna

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name	:	**DIPLOMA IN MECHANICAL ENGINEERING**
Course Code	:	
Subject Code	:	M-561
Semester	:	VI
Subject Title	:	**INDUSTRIAL ENGINEERING AND MANAGEMENT**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	Instructions		Examination				Duration
	Hours / Week	Hours / Semester	Marks				
INDUSTRIAL ENGINEERING AND MANAGEMENT	6	90	Internal Assessment	Board Examination	Total		3 Hrs
			25	75	100		

Topics and Allocation of Hours:

Unit No	Topics	Hours
I	PLANT ENGINEERING AND PLANT SAFETY	17
II	WORK STUDY, METHOD STUDY AND WORKMEASUREMENT	17
III	PRODUCTION PLANNING AND QUALITY CONTROL	17
IV	PRINCIPLES, PERSONNEL MANAGEMENT ANDORGANIZATIOAL BEHAVIOR	16
V	FINANCIAL AND MATERIAL MANAGEMENT	16
	TEST AND REVISION	7
	Total	**90**

RATIONALE:

In the Indian Economy, Industries and Enterprises always find prominent place. After globalization, the students should be trained not only in manufacturing processes but also in managing activities of industries. The knowledge about plant, safety, work study techniques, personnel management and financial management will definitely mould the students as managers to suit the industries.

OBJECTIVES:

- To study the different types of layout.
- To study the safety aspects and its impacts on an organization.
- To study different work measurement techniques.
- To study production planning and control and its functions.
- To study basic and modern management techniques.
- To study the staff selection procedure and training of them.
- To study capital and resources of capital.
- To study inventory control system.
- To study about organization and it's behavior.

INDUSTRIAL ENGINEERING AND MANAGEMENT
DETAILED SYLLABUS

UNIT I (17)
ENGINEERING MATERIALS, JOINTS AND FASTENERS
General Considerations in Machine Design: Engineering materials - Factors affecting selection of material – BIS designation of Ferrous materials – Preferred number - Factor of safety and allowable stress – Stresses: Tension, Compression, Shear, Bearing pressure Intensity, Crushing, bending and torsion - problem.
Creep strain and Creep Curve- Fatigue, S-N curve, Endurance Limit - Stress Concentration – Causes & Remedies
Theories of Elastic Failures – Principal normal stress theory, Maximum shear stress theory & maximum distortion energy theory.
Joints: Design of sleeve and cotter joint, knuckle joint and welded joint.
Fasteners: Design of bolted joints - eye bolts.

UNIT II (17)
DESIGN OF SHAFTS, KEYS AND COUPLINGS
Shafts: Design of shafts subjected to – twisting moment – bending moment – combined twisting and bending moments – fluctuating loads – design of shafts based on rigidity.
Keys: Types of keys - design of sunk keys only - Effect of keyways on shaft-problems.
Couplings: Requirements of good couplings – types - design of – rigid protected type flange couplings - marine couplings – pin type flexible coupling (Description only).

UNIT III (17)
DESIGN OF FLAT BELTS AND V-BELTS
Flat Belts: Types of belts - materials for belt –- types of belt drives – Speed ratio – effect of slip - length of flat belts –Tension Ratio $T1/T2 = e^{\mu\theta}$ – centrifugal tension - power transmitted – condition for maximum power - transmission – Initial Tension - problems – design procedure of flat belts - design of flat belt based on manufacturer's data only – problems.

V-Belts: V-belt drive - comparison with flat belt drive - designation of V-belts – length of belt - power transmitted – Design of V-belt   using manufacturer's data only – Problem.

UNIT IV   (16)
DESIGN OF BEARINGS
Bearings: Classifications of bearings – sliding contact and rolling contact bearings - radial and thrust bearings - roller bearing – types - Designation of ball bearings - materials used for bearings – journal bearings - heat generated - heat dissipated - cooling oil requirement – problems - design of journal bearings –Problems.
Design based on approved data books only.

UNIT V   (16)
DESIGN OF LEVERS AND SPUR GEARS
Levers: Types of levers – applications - mechanical advantage – leverage - displacement ratio - design of-hand lever-foot lever-cranked lever - problems.

Spur gears: Gear drives - merits and demerits over belt drive – Classification of gears - gear materials - spur gear terminology - design of spur gears based on Lewis & Buckingham equation - Problems – speed reducer – types –(Approved data books only).

Text Book:
4. Machine Design, Pandya& Shah, Edn. 1995, Charotar Publishing House.
5. Machine Design,T. V. Sundararajamoorthy& N. Shanmugam, Revised   Edition,   June-2003– Anuradha Publications, Kumbakonam.
6. Design Data Book – by PSG College of Technology, DPV Printers, Coimbatore.

Reference Books:
4. A text book of Machine Design, R.S. Khurmi&J.K.Gupta, Edn. 18,Eurosia Publishing House Pvt. Limited, New Delhi-110 055.
5. Machine Design – Bandari.
6. Theory and Problems of Machine Design, Holowenko, Laughlin, Schaum's outline Series.

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Subject Code : M-562

Semester : VI

Subject Title : **COMPUTER AIDED DESIGN AND MANUFACTURING**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination			
COMPUTER AIDED DESIGN AND MANUFACTURING	Hours / Week	Hours / Semester	Marks			Duration
	5	75	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

Topics and Allocation of Hours:

Unit No	Topics	Hours
I	COMPUTER AIDED DESIGN	14
II	COMPUTER AIDED MANUFACTURING	14
III	CNC PROGRAMMING, RAPID PROTOTYPING	14
IV	COMPUTER INTEGRATED MANUFACTURING, FLEXIBLEMANUFACTURINGSYSTEMS,AUTOMATIC GUIDEDVEHICLE, ROBOT	13
V	CONCURRENT ENGINEERING, QUALITY FUNCTIONDEPLOYMENT,PRODUCT DEVELOPMENTCYCLE,AUGMENTED REALITY	13
	TEST AND REVISION	7
	TOTAL	**75**

RATIONALE:

As per the latest requirements in the Industries this enables to learn the assistance of computer in the field of design and manufacturing areas. It's able to learn the latest manufacturing concepts of in the

shop floors and manufacturing methods like RPT. They are able to know about the CNC programming techniques are included.

OBJECTIVES:
- Understand the concept and requirement of the integration of the design and manufacturing.
- Acquire knowledge about the computer assistance in the design process and analysis.
- Understand the concepts of manufacturing with computer assistance in the shop floor.
- Understand the principle of latest manufacturing machines like RPT.
- Acquire the knowledge in the material handling equipment and robot.
- Understand the Computer Integrated Manufacturing and FMS.
- Study of Concurrent Engineering and its tools and Augmented Reality.

COMPUTER AIDED DESIGN AND MANUFACTURING
DETAILED SYLLABUS

UNIT I (14)
COMPUTER AIDED DESIGN
Computer Aided Design: Introduction – definition – Shigley'sdesignprocess – Ohsuga Model - CAD activities – benefits of CAD –CADsoftwarepackages.Transformations: 2D & 3D transformations – translation, scaling,rotation and concatenation.
Geometric modelling: Techniques - Wire frame modelling –applications – advantages and disadvantages. Surface modelling –types of surfaces – applications – advantages and disadvantages – Solid modelling – entities – advantages and disadvantages – Booleanoperations - Boundary representation – Constructive Solid Geometry– Comparison.
Graphics standard: Definition – Need - GKS – OpenGL - IGES –DXF.
Finite Element Analysis: Introduction – Development - Basic steps– Advantage.

UNIT II (14)
COMPUTER AIDED MANUFACTURING
Computer Aided Manufacturing: Introduction - Definition – functions of CAM – benefits of CAM.
Group technology: Part families - Parts classification and coding -coding structure – Optiz system, MICLASS system and CODESystem.
Process Planning: Introduction – Computer Assisted ProcessPlanning (CAPP) – Types of CAPP - Variant type, Generative type –advantages of CAPP.

Production Planning and Control (PPC): Definition – objectives -Computer Integrated Production management system – MasterProduction Schedule (MPS) – Capacity Planning – MaterialsRequirement Planning (MRP) – Manufacturing Resources Planning(MRP-II) – Shop Floor Control system (SFC) - Just In Timemanufacturing philosophy (JIT) - Introduction to Enterprise ResourcesPlanning (ERP).

UNIT III (14)
CNC PROGRAMMING, RAPID PROTOTYPING
CNC PART PROGRAMMING: Manual part programming - coordinate system – Datum points: machine zero, work zero, tool zero - reference points - NC dimensioning – G codes and M codes – linear interpolation and circular interpolation - CNC programprocedure - sub-program – canned cycles - stock removal – thread cutting – mirroring – drilling cycle – pocketing.

Rapid prototyping: Classification – subtractive – additive–advantages and applications - materials. Types - Stereo lithography (STL) – Fused deposition model (FDM) – Selective laser sintering SLS) - three dimensional printing (3D) – Rapid tooling.

UNIT IV (13)
COMPUTERINTEGRATEDMANUFACTURING,FLEXIBLE

MANUFACTURING SYSTEMS, AUTOMATIC GUIDED VEHICLE,ROBOT CIM: Introduction of CIM – concept of CIM - evolution of CIM – CIM wheel – Benefits – integrated CAD/CAM.

FMS: Introduction – FMS components – FMS layouts – Types of FMS: Flexible Manufacturing Cell (FMC) – Flexible Turning Cell (FTC) – Flexible Transfer Line (FTL) – Flexible Machining System (FMS) – benefits of FMS - introduction to intelligent manufacturing system.

AGV: Introduction – AGV - working principle – types – benefits. ROBOT: Definition – robot configurations – basic robot motion – robot programming method – robotic sensors – end effectors – mechanical grippers – vacuum grippers - Industrial applications of Robot: Characteristics - material transfer and loading – welding - spray coating - assembly and inspection.

UNIT V (13)
CONCURRENTENGINEERING,QUALITYFUNCTIONDEPLOYMENT,PRODUCTDEVELOPMENTCYCLE,
AUGMENTED REALITY

Concurrent Engineering: Definition – Sequential Vs Concurrent engineering – need of CE – benefits of CE.

Quality Function Deployment (QFD): Definition – House of Quality (HOQ) – advantages – disadvantages. Steps in Failure Modes and Effects Analysis (FMEA) – Value Engineering (VE) – types of values– identification of poor value areas – techniques – benefits. Guide lines of Design for Manufacture and Assembly (DFMA).

Product Development Cycle: Product Life Cycle - New product development processes.

Augmented Reality (AR): Introduction - concept – Applications.

Text Books :
1. CAD/CAM/CIM ,R.Radhakrishnan, S.Subramanian, New Age International Pvt. Ltd.
2. CAD/CAM ,MikellP.Groover, Emory Zimmers, Jr.Prentice Hall of India Pvt., Ltd.

Reference Books:
1. CAD/CAM Principles and Applications, Dr.P.N.Rao, Tata McGraw Hill Publishing Company Ltd.
2. CAD/CAM, Ibrahim Zeid, Mastering Tata McGraw-Hill Publishing Company Ltd., New Delhi.
3. Automation, Production Systems, and Computer-Integrated Manufacturing, Mikell P. Groover, Pearson Education Asia.
4. Computer control of manufacturing systems, YoramKoren, McGraw Hill Book.

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name   :   DIPLOMA IN MECHANICAL ENGINEERING

Course Code   :

Subject Code   :   M-5631

Semester   :   VI

Subject Title   :   **AUTOMOBILE ENGINEERING**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination			
	Hours / Week	**Hours / Semester**	**Marks**			**Duration**
AUTOMOBILE ENGINEERING	5	75	**Internal Assessment**	**Board Examination**	**Total**	3 Hrs
			25	75	100	

Topics and Allocation of Hours:

Unit No	Topics	Hours
I	AUTOMOBILE ENGINES	14
II	FUEL AND FUEL FEED SYSTEMS	14
III	TRANSMISSION AND POWER TRAINS	14
IV	AUTOMOBILE CHASSIS	13
V	AUTOMOBILE ELECTRICAL EQUIPMENT & POLLUTION CONTROL	13
	TEST AND REVISION	7
	TOTAL	**75**

RATIONALE:

Automobile is one of the key areas of development in India facilitated by Multinational Companies. As Automobile is the Major sources of employing man power a thorough knowledge on Automobile Engine construction and its functioning is required with due consideration on pollution control.

OBJECTIVES:

- Explain the automobile engines and its components.
- Explain the cooling system and lubrication system of the IC engines.
- Explain the fuel and fuel feed system.
- Explain the transmission systems and power trains of automobile.
- Study about the Brake systems and electrical components.
- Study the pollution and its standards.

AUTOMOBILE ENGINEERING
DETAILED SYLLABUS

UNIT- I (14)
AUTOMOBILE ENGINES
Basic Engine Components – Functions, types, materials and construction of Cylinder block – Crankcase – Oil pan – Cylinder head – Gaskets – Cylinder liners – Comparison of liners – Piston – Expansion control in pistons – Piston rings – types of compression rings and oil control rings – piston pin – Connecting rod – methods of connecting piston and connecting rod – Crankshaft – flywheel – Cam shaft – methods of camshaft drive arrangements – Valve and valve mechanism – L-I-F-T. Diesel engine – Stages of combustion – Delay period – Variables affecting delay period – Methods of generating air swirl in diesel engine. Combustion chambers – Types of combustion chambers – merits and demerits – thermo siphon system – pump assisted water cooling systems – components – water pump, fan – thermostat – types – Radiator – types – pressure cap – vapour recovery cooling system – merits – vented and pressurized expansion tank – temperature sensors – troubles in cooling system – loss of coolant, overheating and over cooling – causes. Lubrication systems – purpose – types of lubricants – additives – Service rating of oil – types of lubricating systems – Full pressure system – techniques of cylinder and piston lubrication – oilo pumps – oil filters – full flow and bypass filter systems – Troubles in lubrication system – Oil leakage, low oil pressure and excessive oil consumption – Causes.

UNIT-II (14)
FUEL AND FUEL FEED SYSTEMS
Requirments of an ideal petrol – Octane number – Detonation – Pre ignition – Properties of a good diesel fuel – Cetane number – Diesel knock – Methods of controlling diesel knock – Comparison of detonation and diesel knock – Fuel additives – Alternate fuels for petrol and diesel engines. Layout of fuel feed system of petrol engine – types of fuel feed systems – A.C Mechanical fuel pump – S.U Electrical fuel pump – fuel filter – Air cleaners – types – Carburetion – Classification of carburetors – Simple carburetor – Defects – Carburetor circuits – Solex carburetor – Construction and operation – Petrol injection – merits and demerits – DTSI – VTI – CCVTI – PGMFI – MPFI system. Layout of diesel fuel feed system – Single acting fuel feed pump – Fuel injection pumps – Construction and working of distributor type pump – CRDI system fuel injectors – types – Single & Multi hole – Pintle and Pintaux – Governors – Mechanical and Pneumatic Governors – fuel filters – Primary and secondary filters.

UNIT-III (14)
TRANSMISSION AND POWER TRAINS
General arrangement of power transmission system – Arrangement of front engine rear drive – rear engine rear drive – front engine front drive – four wheel drive – applications – clutch – function – Components – Types – Single plate, multi plate and diaphragm spring clutch – fluid coupling – Clutch troubles and their causes. Gear box – purpose – various resistance to motion – types of gear boxes –

Sliding mesh, constant mesh and synchromesh – floor shift gear changer – gear box troubles and their causes. Drive line – propeller shaft – universal joint – cross type only – slip joint – final drive – function – types of gear arrangement – Straight & spiral, bevel, Hypoid, Worm and worm wheel – merits, demerits and application – Hotch kiss drive – Torque tube drive – radius rod. Differntial – purpose – Construction and operation – Self locking and non slip differential – Differential troubles and their causes – forces in the rear axles – Semi floating, three quarter floating and full floating rear axles – Axle housing – types.

UNIT-IV (13)
AUTOMOBILE CHASSIS
Front axle – Types – Stub axle – Types – Steering system – Ackermann principle of steering – Wheel alignment – Factors – Camber, Caster, King pin inclination, Toe in and Toe out on turns – Steering linkages – Steering gears – Cam and double roller, recirculating ball type, Rack and pinion – Steering troubles and causes – power steering – Necessity – types – layout of anyone type – Collapsible steering system. Suspension system – Functions – Type of springs – Leaf, Coil and Torsion bar – Front suspension systems – Independent front suspension – Merits and demerits – types – Rear end suspension – Air suspension – Shock absorber – Purpose – Telescopic type – Construction and working. Brake system – functions – Classification of brakes – drum brakes – Leading shoe and trailing shoe – Self energizing action – hydraulic brake – brake bleeding – Air assisted hydraulic brakes – Air brake – Layout, functions of each component and application only – Disc brakes – Construction and working – Comparison of disc and drum type – brake troubles and their causes – Anti lock brake system. Wheels – types of wheels – brief description and applications – Tyres – Function – Construction of tyres – cross and radial ply tyres – comparison – properties of tyres – tubeless tyre – tyre wear and tyre service.

UNIT-V (13)
AUTOMOBILE ELECTRICAL EQUIPMENT & POLLUTION CONTROL
Battery – Lead acid battery – Nickel alkaline battery – Construction – battery rating – Charging – Testing – Starting circuit – Construction and operation of starter motor – Starting motor drives – Over running clutch and Bendix drive – Construction and operation – Solenoid switch – Charging circuit – Alternator – Construction and operation – regulators – Dynamo. Ignition system – Types – Battery coil ignition system – High tension magneto – Electronic ignition – Ignition system troubles and remedies.Lighting system – Circuit – Head light – Aiming and adjustment – Sealed beam head lights – Directional signal circuits – fluorescent lamp – Horn circuits – Wind screen wiper. Pollution – Pollutants – Source of pollutants – Pollution control techniques for petrol and diesel engine emissions – Controlling crank case emission (PCV) – Controlling evaporative emission (VRS,VSS, VVR, ECS and EEC) – Treatement of exhaust gas (Catalytic converter, EGR) – Introduction to automobile electronics – Radio interference – Suppressors – Audio, Video systems.

Text Books:
1. Automobile engineering vol-1, vol-2, Kirpalsingh, Standard publishers distributors, New Delhi.
2. Automobile Engineering, G.B.S.Narang, Khanna Publishers, New Delhi.
3. Automotive Mechanics, William H.Crouse and Donald. L.Anglin, Tata McGraw Hill Publishing Company Ltd, New Delhi.
4. The Automobile, Harbans Singh Reyat, S.Chand& Co Ltd, New Delhi.

Reference Books:
1. Vehicle and Engine Technology, Vol-I, Heinz Heisler, ELBS.
2. Automotive Mechanics, Joseph Heitner, East-West Press (P) Ltd, New Delhi.
3. Internal Combustion Engines, M.L. Mathur& R.P. Sharma, DhanpatRai& Sons, New Delhi.

4. Automobile Engineering, R.B. Gupta, SatyaPrakashan, New Delhi.

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name	:	DIPLOMA IN MECHANICAL ENGINEERING
Course Code	:	
Subject Code	:	M-5632
Semester	:	VI
Subject Title	:	**ROBOTICS**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination				
ROBOTICS	**Hours / Week**	**Hours / Semester**	**Marks**				**Duration**
	5	75	**Internal Assessment**	**Board Examination**	**Total**		3 Hrs
			25	75	100		

Topics and Allocation of Hours:

Unit No	Topics	Hours
I	FUNDAMENTALS OF ROBOT TECHNOLOGY	14
II	ROBOT CONTROLLER, DRIVE SYSTEMS ANDEND EFFECTERS	14
III	SENSORS AND MACHINE VISION	14
IV	ROBOT KINEMATICS AND ROBOTPROGRAMMING	13
V	ROBOT APPLICATIONS IN MANUFACTURING	13
	TEST AND REVISION	7
	TOTAL	**75**

RATIONALE

Rapid industrialization and globalization needs industries to be more competitive and deliver cost effective quality products. This needs industries to implement flexible manufacturing systems where Robotic technology plays major role. Hence study of robotic tchology is very essential

OBJECTIVES:

- Understand fundamentals of robotics
- Acquire knowledge structure and elements of robot
- Gain knowledge on controller and various drives used in robotics
- Develop knowledge on role of sensors and vision system
- Acquire skill to program and control robot
- Understand to adopt robot to various industrial applications.

ROBOTICS
DETAILED SYLLABUS

UNIT I (14)
FUNDAMENTALS OF ROBOT TECHNOLOGY
Introduction – History of robot - Definitions-Robot Anatomy – Basic configuration of Robotics – Robot Components – Manipulator, End effecter, Driving system, Controller and Sensors. Mechanical arm – Degrees of freedom – Links and joints – Types of joints – Joint notation scheme – Pitch, Yaw, Roll – Classification of robots – Work envelope, Work Volume – Effect of structure on Control ,Work envelop and Work volume. Introduction to PUMA robot.

UNIT II (14)
ROBOT CONTROLLER, DRIVE SYSTEMS AND END EFFECTERS
Robot controller – Configuration - Four types of controls – Open loop and closed loop controls – Speed of response and stability – Precision of movements: Spatial resolutions, accuracy and repeatability. Pneumatic drives – Hydraulic drives – Mechanical drives – Electrical drives – Stepper motors, DC Servo motors and AC Servo motors – Salient features – Applications and Comparisons of Drives. Endeffecters – Grippers – Mechanical Grippers, Magnetic Grippers, Vacuum Grippers, Two fingered andThree fingered Grippers, Internal and External Grippers – End OfArm Tooling (EOAT)- Selection and Design considerations.

UNIT III (14)
SENSORS AND MACHINE VISION
Requirements of Sensors – Sensor devices used in robot workcell - Principles and applications of the following types of sensors –Position sensors: Piezo-electric sensors, LVDT, Resolvers, Opticalencoders and Pneumatic position sensors – Range sensors –Proximity sensors: Inductive, Capacitive, Ultrasonic and Opticalproximity sensors – Touch sensors: Binary sensors, Analogsensors – Wrist sensors – Slip sensors. Machine vision system –Camera – Frame grabber – Sensing and digitizing image data –Signal conversion – Image storage – Lighting techniques – Imageprocessing and analysis – Data reduction: Edge detection, Featureextraction and object recognition – Applications – Inspection,Identification, Visual serving and navigation.

UNIT IV (13)
ROBOT KINEMATICS AND ROBOT PROGRAMMING
Forward kinematics, Inverse kinematics and differences – Forwardkinematics and Reverse kinematics of manipulators with Two andThree degrees of freedom – Deviations. – Robot dynamics – Static   Lead

through programming – Robot programming languages – VALProgramming – Motion commands, Sensor commands, Endeffecter commands and Simple programs.

UNIT V (13)
ROBOT APPLICATIONS IN MANUFACTURING
Robot applications – Material handling – Press loadingandunloading – Die casting – Machine tool loading and unloading – Spot welding – Arc welding – Spray painting – Assembling – Finishing – Automatic Guided Vehicle – Adopting robots to workstations – Requisite robot characteristics and Non requisite robot characteristics – Stages in selecting robots for industrial applications – Safety considerations for robot operations – Robotics in the future and characteristics task– Economical analysis of robots – Social implications.

Text Books:
1. Industrial Robotics – Technology, Programming and Applications, .P.Groover, MC Graw Hill, 2001

Reference Books:
1. Robotics Control, Sensing, Vision and Intelligence, Fu.K.S.Gonzalz.R.C., and Lee C.S.G, McGraw-Hill Book Co., 1987
2. Robotics for Engineers,YoramKoren, McGraw-Hill Book Co., 1992
3. Robotics and Image Processing, Janakiraman.P.A, Tata McGraw-Hill,1995

(Implements from the Academic year 2015-2016 onwards)

Course Name	:	DIPLOMA IN MECHANICAL ENGINEERING
Course Code	:	
Subject Code	:	M-5633
Semester	:	VI
Subject Title	:	**REFRIGERATION AND AIR-CONDITIONING**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination				
REFRIGERATION AND AIR-CONDITIONING	**Hours / Week**	**Hours / Semester**	**Marks**				**Duration**
	5	75	**Internal Assessment**	**Board Examination**	**Total**		3 Hrs
			25	75	100		

Topics and Allocation of Hours:

Unit No	Topics	Hours
I	REFRIGERATION SYSTEM AND REFRIGERATIONEQUIPMENTS	14
II	VAPOUR COMPRESSION & ABSORPTIONREFRIGERATION SYSTEM AND CRYOGENICREFRIGERATION SYSTEMS	14
III	REFRIGERATION FLOW CONTROLS, REFRIGERANTSAND LUBRICANTS AND APPLICATIONS OFREFRIGERATION	14
IV	PSYCHOMETRICS AND COMFORT AIR CONDITIONINGSYSTEMS	13
V	COOLING LOAD CALCULATIONS AND DUCT DESIGN ,ENERGY CONSERVATION TECHNIQUES	13
	TEST AND REVISION	7
	TOTAL	**75**

RATIONALE:

Hence the study of refrigeration principles, system and its effectiveness are essential. Comfort is the basic requirement of customers and machines through air-conditioning and hence learning the concept of air-conditioning and methods of air-conditioning facilitates quality design of air conditioners.

OBJECTIVES:

- Explain the working of open and closed air system of refrigeration.
- Describe the working and construction of compressors used for air conditioning.
- Explain vapour compression refrigeration system.
- Explain vapour absorption refrigeration system.
- Compare the properties and applications of various refrigerants.
- Define the parameters used in psychrometry.
- Use Psychrometry chart
- Describe the equipment used for air conditioning.
- Estimate the cooling load for the given requirement.
- Explain the industrial application of refrigeration.

REFRIGERATION AND AIR-CONDITIONING
DETAILED SYLLABUS

UNIT I (14)
REFRIGERATION SYSTEM AND REFRIGERATION EQUIPMENTS

Thermodynamic state of a pure substance, modes of heat transfer – laws of heat transfer - mechanisms of production of cold - unit of refrigeration –types of refrigeration - reversed Carnot cycle - C.O.P of heat engine-heat pump- refrigerating machine – principle of working of open and closed air system of refrigeration – advantages and disadvantages – and its application of air cycle-problemsCompressor – principle of working and constructional details of reciprocating and rotary compressors, hermetically and semi hermetically sealed compressors- condensers-principle of working andconstructional details of air cooled and water cooled condensers,evaporative condensers- advantages and disadvantages - natural andforced draught cooling towers.

Evaporators- natural circulation and forced circulation type – principleof working constructional details.

UNIT II (14)
VAPOUR COMPRESSION REFRIGERATION SYSTEM,VAPOURABSORPTIONREFRIGERATIONSYSTEMANDCRYOGENICREFRIGERATION SYSTEMS

Principle of working of vapour compression system – analysis of vapour compression cycle using T-s diagram and p-H diagram-refrigerating effect- compression work - C.O.P - effect of superheating and under cooling – effect of evaporative pressure and condenser pressure-problems – liquid vapour refrigeration heat exchangers - advantages and disadvantages of superheating and under cooling – use of flash chamber and accumulator.

Simple absorption system – Electrolux system - solar absorption refrigeration system- absorption system comparison with mechanical refrigeration system.

Refrigerators for above 2 K- Philips Refrigerator--GifferedMcMohan refrigerator- refrigerators for below 2 K - Magnetic refrigeration systems.

UNIT III (14)
REFRIGERATION FLOWCONTROLS, REFRIGERANTS ANDLUBRICANTS AND APPLICATIONS OF REFRIGERATION

Capillary tube-automatic expansion valve-thermostatic expansion valve-electronic expansion valve-solenoid valve-evaporator pressure regulator –suction pressure regulator-classification of refrigerants-selection of a refrigerant-properties and applications of following refrigerants SO2 , CH4 ,F22, and NH3 – CFCs refrigerants- equivalent of CFCs refrigerants (R-123a,R-143a,R-69S)- blends of refrigerants(R400 and R500 Series) - lubricants used in refrigeration and their applications.

Slow freezing –quick freezing- cold storage-frozen storage-freeze drying –dairy refrigeration –ice cream cabinets-ice making – water
cooler, milk cooler, bottle cooler-frost free refrigeration.

UNIT IV (13)
PSYCHOMETRICSAND COMFORTAIRCONDITIONINGSYSTEMS

Psychrometry properties - adiabatic saturation of air by evaporation of water- psychometric chart and its uses – psychometric processes – sensible heating and cooling - humidifying and heating - dehumidifying and cooling - adiabatic cooling with humidification - total heating or cooling processes - sensible heat factor - by pass factor – adiabatic mixing – evaporative cooling - problems – governing optimum effective temperature – comfort chart-design consideration.

Equipment for air conditioning and insulation factors – air purification – temperature control – humidity control – dry and wet filters- centrifugal dust collector – air washer humidifier – dehumidifier - fans and blowers– grills and registers – summer and winter air conditioning, window and split air conditioners – properties of ideal insulator, types of insulating materials .

UNIT V (13)
COOLING LOAD CALCULATIONS AND DUCT DESIGN, ENERGYCONSERVATION TECHNIQUES

Different heat sources – conduction heat load – radiation load of sun – occupants load – equipment load - infiltration air load – miscellaneous heat sources –fresh air load - problems.
Classification of duct systems - Duct design – equal friction method – velocity reduction method – problems.Chilled water Systems -Air handling Units.
Energy conservation and design decisions - heat reclaim – thermal storage – ice builder – ice harvester – variable refrigerant flow (VRF) – variable primary flow (VPF).

Text books :
1. Refrigeration and air conditioning, P.L .Ballaney, Khanna Publishers, 2B, North Market, Naisarak, New Delhi 110 006.
2. Refrigeration and air conditioning, V.K. Jain,
3. Industrial Refrigeration Hand Book, Wilbert F. Steocker

Reference Books:
1. A course in refrigeration and air conditioning , Domkundwar,
2. Principles of refrigeration, Dossat
3. Home refrigeration and air conditioning, Audels, Theo.Audel& Co. publisher, 199 Edn.49, West 23rd Street, New York. - 1998
4. Refrigeration and air conditioning, C.P Arora
5. Cryogenic systems RandellFd Barron.

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name	:	DIPLOMA IN MECHANICAL ENGINEERING
Course Code	:	
Subject Code	:	M-564
Semester	:	VI
Subject Title	:	**COMPUTER AIDED DESIGN AND MANUFACTURINGPRACTICAL**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination				
COMPUTER AIDED DESIGN AND MANUFACTURING PRACTICAL	**Hours / Week**	**Hours / Semester**	**Marks**				**Duration**
	6	90	**Internal Assessment**	**Board Examination**	**Total**		3 Hrs
			25	75	100		

OBJCETIVES

- Study of parametric modeling.
- Understand the part modeling and assembly of parts
- Create the views of the solid model and parts list.
- Study the working principle of CNC machines
- Study the datum points and offsets.
- Differentiate incremental System with absolute system
- Study the simulation software package.
- Write program and simulate in the Lathe software and Milling software.
- Prepare a part program, edit and execute in CNC Turning centre.
- Prepare a part program, edit and execute in CNC Machining centre.
- Produce components in the CNC Turning centre and CNC Machining centre.

PART A: Solid modeling (30 Hrs.)

Introduction

Part modelling - Datum Plane – constraint – sketch – dimensioning – extrude – revolve – sweep – blend – protrusion – extrusion – rib – shell – hole – round – chamfer – copy – mirror – assembly – align – orient.

Exercises

- 3D Drawing
- Geneva Wheel
- Bearing Block
- Bushed bearing
- Gib and Cotter joint
- Screw Jack
- Connecting Rod

Note: Print the orthographic view and sectional view from the above assembled 3D drawing.

PART B: CNC Programming and Machining (45 Hrs.)

Introduction:
- Study of CNC lathe, milling.
- Study of international standard codes: G-Codes and M-Codes
- Format – Dimensioning methods.
- Program writing – Turning simulator – Milling simulator, IS practice – commands menus.
- Editing the program in the CNC machines.
- Execute the program in the CNC machines.

Exercises

Note: Print the part program from the simulation software and make the component in the CNC machine.

CNC Turning Machine   Material: M.S / Aluminum / Acrylic fibre / Plastic

1. Using Linear and Circular interpolation - Create a part program and produce component in the Machine.
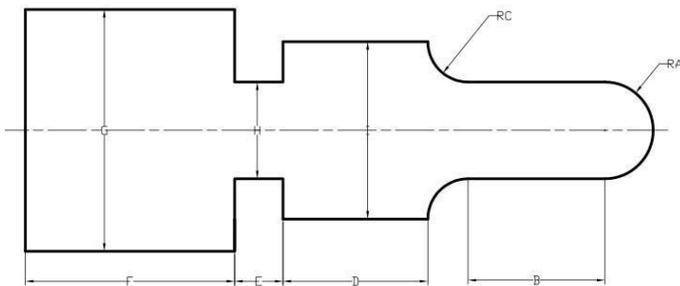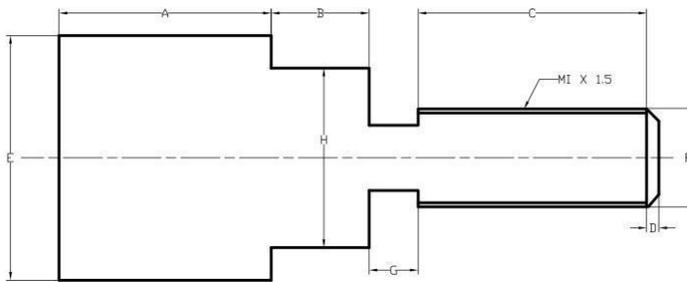
2. Using Stock removal cycle – Create a part program for multiple turning operations and produce component in the Machine.
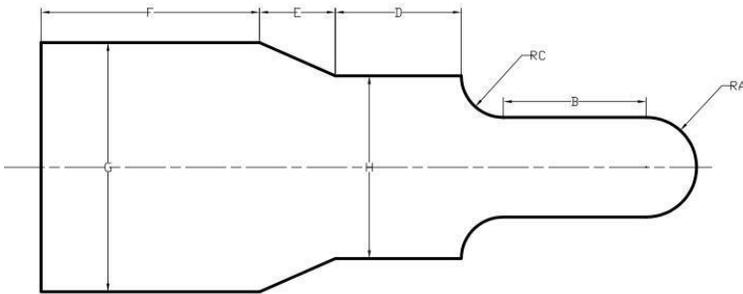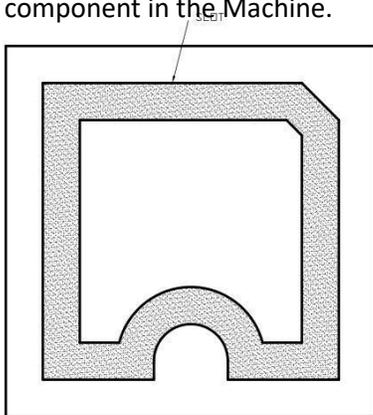

3. Using canned cycle - Create a part program for thread cutting, grooving and produce component in the Machine.
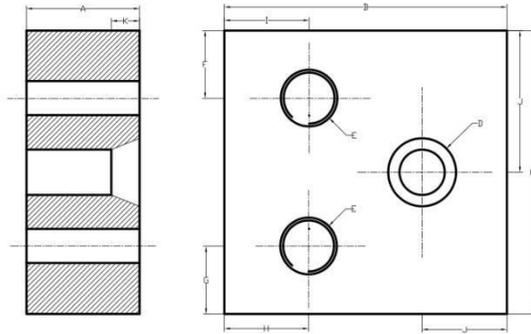
CNC Milling Machine   Material: M.S / Aluminum / acrylic fibre / plastic

4. Using Linear interpolation and Circular interpolation – Create a part program for grooving and produce component in the Machine.

5. Using canned cycle - Create a part program for drilling, tapping, counter sinking and produce component in the Machine.

6. Using subprogram - Create a part program and produce component in the Machine
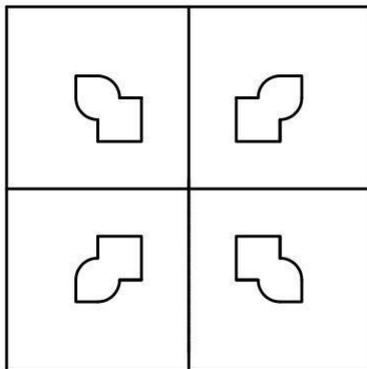
References:
CNC Programming & Operations, Sankar, Sathish and Balamurugan – Micro Publications, Tiruchy.

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name   :   DIPLOMA IN MECHANICAL ENGINEERING

Course Code   :

Subject Code   :   M-565

Semester   :   VI

Subject Title   :   **MACHINE TOOL TESTING AND MAINTENANCE PRACTICAL**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination				
MACHINE TOOL TESTING AND MAINTENANCEPR ACTICAL	**Hours / Week**	**Hours / Semester**	**Marks**				**Duration**
	4	60	**Internal Assessment**	**Board Examination**	**Total**		3 Hrs
			25	75	100		

OBJECTIVES:
- Study of Indian Standard Test charts.
- Set up instrument for machine tool testing.
- Observe the machine tool alignment and results.
- Observe the manufacturing accuracy of machine tools.
- Study the maintenance of the machine components.
- Study the trouble shooting procedures and methods.
- Prepare the record of work for all the exercises.

MACHINE TOOL TESTING
- Conduct geometrical test on machines with permissible deviations.
- Study the testing instruments and calibration to the standards.
- Prepare a test chart for the various tests and mention the errors.

Part A: Machine Tool Alignment
EXERCISES

1. Conduct the following test for the lathe machine and prepare a test chart. Check the level of slideways.
- Check the straightness of carriage movement.
- Check the parallelism of tailstock movement to carriage movements.

- Check the run-out of the spindle.
- Check the parallelism of the axis of the outside of tailstock sleeve to carriage movement.

2. Conduct the following test for the shaping machine and prepare a test chart. Check the flatness of table top face.
- Check the parallelism of table top face to its transverse movement.
- Check the parallelism of table top face to the ram movement.
- Check the parallelism of T-slot of top face to the ram movement.
- Check the squareness of table side face to its transverse movement.

3. Conduct the following test for the drilling machine and prepare a test chart. Check the level of the machine.
- Check the flatness of the table surface.
- Check the run-out of the internal taper of the spindle.
- Check the straightness of the pillar and squareness of the spindle axis.
- Check the squareness of the table surface to the vertical movement of the spindle housing

4. Conduct the following test for the surface grinding machine and prepare a test chart.
- Verify the levelling of slideways.
- Verify the straightness of slideways in a horizontal plane. Verify the flatness of the table surface.
- Verify the parallelism of the table surface. Check the run-out of the wheel spindle nose.

5. Conduct the following test for the milling machine and prepare a test chart.
- Check the straightness of the vertical movement of the knee.
- Check the squareness of the table surface to the column ways for knee.
- Check the flatness of the table surface.
- Check the parallelism of the table surface to its movement.
- Check the run-out of the internal taper of the spindle.

6. Conduct the following test for the slotting machine and prepare a test chart.
- Check the flatness of the table top face.
- Check the run-out of the central locating bore.
- Check the parallelism of table surface to its movement in longitudinal direction.
- Check the squareness of the longitudinal and transverse movements of table.
- Check the squareness of ram movement to the table surface in the transverse direction.

Part B: Maintenance

Dismantle, inspect and assemble the following machine components.
1. Lead screw and nut
2. Tailstock
3. Bench vice
4. Three jaw chuck
5. Four jaw chuck
6. Drill chuck

BOARD EXAMINATION

Note: Examinations will be conducted in both Part A and Part B. Students should be given exercises by selecting one exercise from each part by lot.

All the exercises should be given in the question paper and students are allowed to select by a lot

Machine Tool Alignment	**45**
Procedure / Drawing	15

Geometrical test	20
Result & Test Chart	10
Maintenance	**25**
Dismantling	10
Trouble shooting procedure	10
Assembling / Report	5
Viva-voce	**5**
TOTAL	**75**

LIST OF EQUIPMENTS

Machine

1. Lathe machine   - 1 No.
2. Shaping machine   - 1 No.
3. Drilling machine   - 1 No.
4. Surface grinding machine - 1 No.
5. Milling machine   - 1 No.
6. Slotting machine   - 1 No.

Tools

7. Dial gauge   - 5 Nos.
8. Magnetic stand   - 5 Nos.
9. Surface gauges   - 5 Nos.
10. Spirit level   - 5 Nos.
11. Spanners (DE/Ring/Box)   - Sufficient quantity
12. Screw drivers   - Sufficient quantity
13. Allen screw sets   - Sufficient quantity
14. Hammer   - Sufficient quantity
15. Test mandrels   - Sufficient quantity
16. Squares / Blocks   - Sufficient quantity

Machine components

17. Lead screw and nut   - 1 No.
18. Tailstock   - 1 No.
19. Bench vice   - 1 No.
20. Three jaw chuck   - 1 No.
21. Four jaw chuck   - 1 No.
22. Drill chuck   - 1 No.

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code :

Subject Code : M-5661

Semester : VI

Subject Title : **AUTOMOBILE ENGINEERING PRACTICAL**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
AUTOMOBILE ENGINEERING PRACTICAL	4	60	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

OBJECTIVES:
- Identify the various tools and their applications used in Automobile.
- Dismantle and assemble parts of petrol engine.
- Dismantle and assemble parts of diesel engine.
- Service AC fuel pump, oil pump and water pump.
- Service carburetors
- Dismantle and assemble fuel injection pump & fuel injectors.
- Dismantle and assemble of power transmission and differential unit.
- Dismantle and assemble steering gear box.
- Testing and charging of batteries.
- Overhauling of starter motor, alternator & dynamo.
- Troubleshoot the electrical circuits in automobiles.

LIST OF EXPERIMENTS
PART – A
1. Identification and application of mechanic's tools.
2. Dismantling and assembling of four stroke petrol engine and diesel engine and identification of parts.

3. Cleaning, inspecting and measuring cylinder bore using cylinder bore dial gauge and suggesting the next over size.
4. Removing decarburizing, inspecting and replacing connecting rods and adjusting the bearings.
5. Removing camshaft, replacing timing gears, removing valves, lapping and adjusting valve clearance.
6. Removing, servicing and replacing of fuel pump, oil pump & water pump.
7. Removing, servicing and replacing of SOLEX carburetor/MPFI system.
8. Dismantling and assembling of inline fuel injection pump/ CRDI system.
9. Dismantling, assembling & testing of injectors.

PART – B

1. Removing and replacing of pressure plate and clutch plate,fingers adjustment.
2. Dismantling, inspecting and assembling of gear box and find out the gear ratios.
3. Dismantling, inspecting and assembling of final drive and differential units. Adjusting of backlash and correct tooth contact of crown and pinion of differential unit.
4. Dismantling, assembling and adjusting of steering gear box and find gear ratio.
5. Test a battery with specific gravity test and charge the battery with constant amperage/voltage method.
6. Dismantling, overhauling and assembling of starter motor.
7. Dismantling, overhauling and assembling of alternator/dynamo
8. Trace the automobile electrical system with respect to battery coil ignition system.
9. Trace the automobile electrical system with respect to (i) horn relay circuit, (ii)Wiper circuit &explain with neat circuit diagram.

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M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

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Course Name	:	DIPLOMA IN MECHANICAL ENGINEERING
Course Code	:	
Subject Code	:	M-5662
Semester	:	VI
Subject Title	:	**ROBOTICS PRACTICAL**

TEACHING AND SCHEME OF EXAMINATIONS:

<div align="right">No. of weeks per semester: 15 Weeks</div>

Subject	Instructions		Examination				
ROBOTICS PRACTICAL	**Hours / Week**	**Hours / Semester**	**Marks**				**Duration**
	4	60	**Internal Assessment**	**Board Examination**	**Total**		3 Hrs
			25	75	100		

Objectives
- Study of Robot / Study of robot simulation software
- To study the components required.
- To study the techniques of programming
- Study of machine vision system
- Prepare a record of work done.

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Exercises

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1. Position recording using Cartesian co-ordinate system - (No. of positions to be specified - 9)
2. Position recording using Polar co-ordinate system - (No. of positions to be specified- 9)
3. Pick and place the objects - No. of objects to be specified- 6)
4. Pick and stack the objects - (No. of objects to be specified- 6)
5. Spray painting practice - (Area to be specified - 300mm x 300mm)
6. Spot welding practice - (No. of spots to be specified - 9)
7. Arc welding practice – (Length of weld to be specified)
8. Assembling practice - (Simple assembling)
9. Profile cutting practice - (Complicated profile – combination of lines and arcs)
10. Machine loading and unloading practice with time delay - (No. of times to be specified- 9)

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name   :   DIPLOMA IN MECHANICAL ENGINEERING

Course Code   :

Subject Code   :   M-5663

Semester   :   VI

Subject Title   :   **REFRIGERATION AND AIR-CONDITIONING PRACTICAL**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination				
REFRIGERATION AND AIR-CONDITIONING PRACTICAL	**Hours / Week**	**Hours / Semester**	**Marks**				**Duration**
	4	60	**Internal Assessment**	**Board Examination**	**Total**		3 Hrs
			25	75	100		

OBJECTIVES:
- Identify the various tools used in R & AC
- Demonstrate the construction and working of window air conditioner
- Demonstrate the construction and working of split type air conditioner
- Set parameters for comfortable operation of an air conditioner.
- Determine the C.O.P of air conditioner.
- Determine the capacity of window air conditioner.
- Describe the wiring of refrigerator and coolers.
- Perform servicing on air conditioner.

PART- A

1. BASIC REFRIGERATION WORKSHOP OPERATION
(a) Copper and steel tubing
- To study the various sizes of copper and steel tubing. To study the various tools used for operations.
- To become familiar with various operations on copper and steel tubing–Flaring, Swaging.

(b) Soldering methods used in R& A.C

2. TO STUDY THE CONSTRUCTION FEATURES OF THE FOLLOWING:
 (a) Domestic refrigerators   (b) Water coolers   (c) Window Air Conditioner
 (d) Split Type Air-Conditioner

3. PROPER METHODS OF SETTING AND ADJUSTING OF
(a)Thermostats
(b) Low pressure and high pressure cut-outs
(c) Thermostatic expansion valve
(d) Automatic Expansion Valve

PART-B
TEST PROCEDURES
1. To determine the refrigerating effect, C.O.P and the compressor capacity of a open type system with Thermostatic expansion valve, Capillary tube, Automatic Expansion Valve
2. To determine the C.O.P of sealed system by using electrical measurements
To determine the capacity of a window air conditioner.
To determine the efficiency of a cooling tower.
Wiring of refrigerator, water cooler, desert cooler, room air conditioner –packaged air conditioner, panel board etc.

SERVICE PROCEDURES
1. To change refrigerant into service cylinder from storage cylinder.
2. To evaluate the entire system
3. To Pump down the system
4. To Purge air from the system
5. To locate the leaks in a system.
6. To charge the system
7. To check the oil level in the compressor.
8. Tracing the common faults in R& A.C units and their remedies.

(Implements from the Academic year 2015-2016 onwards)

Course Name	:	DIPLOMA IN MECHANICAL ENGINEERING
Course Code	:	
Subject Code	:	M-567
Semester	:	VI
Subject Title	:	**PROJECT WORK**

TEACHING AND SCHEME OF EXAMINATIONS:

No. of weeks per semester: 15 Weeks

Subject	Instructions		Examination				
PROJECT WORK	**Hours / Week**	**Hours / Semester**	**Marks**				**Duration**
	4	60	**Internal Assessment**	**Board Examination**	**Total**		3 Hrs
			25	75	100		

OBJECTIVES:
- Implement the theoretical and practical knowledge gained through the curriculum into an application suitable for a real practical working environment preferably in an industrial environment
- Get exposure on industrial environment and its work ethics. Understand what entrepreneurship is and how to become an entrepreneur.
- Learn and understand the gap between the technological knowledge acquired through curriculum and the actual industrial need and to compensate it by acquiring additional Knowledge as required.
- Carry out cooperative learning through synchronous guided discussions within the class in key dates, asynchronous document sharing and discussions, as well as to prepare collaborative edition of the final project report.
- Understand the facts and importance of environmental management. Understand and gain knowledge about disaster management.

PROJECT WORK
ENVIRONMENTAL & DISASTER MANAGEMENT
1. ENVIRONMENTAL MANAGEMENT
Introduction – Environmental Ethics – Assessment of Socio Economic Impact –
Environmental Audit – Mitigation of adverse impact on Environment – Importance of Pollution Control – Types of Industries and Industrial Pollution.

Solid waste management – Characteristics of Industrial wastes – Methods of Collection, transfer and disposal of solid wastes – Converting waste to energy – Hazardous waste management Treatment technologies.

Waste water management – Characteristics of Industrial effluents – Treatment and disposal methods – Pollution of water sources and effects on human health.

Air pollution management – Sources and effects – Dispersion of air pollutants – Air pollution control methods – Air quality management.

Noise pollution management – Effects of noise on people – Noise control methods.

2. DISASTER MANAGEMENT
Introduction – Disasters due to natural calamities such as Earthquake, Rain, Flood, Hurricane, Cyclones etc – Man made Disasters – Crisis due to fires, accidents, strikes etc – Loss of property and life..

Disaster Mitigation measures – Causes for major disasters – Risk Identification – Hazard Zones – Selection of sites for Industries and residential buildings – Minimum distances from Sea – Orientation of Buildings – Stability of Structures – Fire escapes in buildings -Cyclone shelters – Warning systems.

Disaster Management – Preparedness, Response, Recovery – Arrangements to be made in the industries / factories and buildings – Mobilization of Emergency Services -Search and Rescue operations – First Aids – Transportation of affected people – Hospital facilities – Fire fighting arrangements – Communication systems – Restoration of Power supply – Getting assistance of neighbors / Other organizations in Recovery and Rebuilding works – Financial commitments – Compensations to be paid – Insurances –Rehabilitation.

LIST OF QUESTIONS
A. ENVIRONMENTRAL MANAGEMENT
1. What is the responsibility of an Engineer-in-charge of an Industry with respect to Public Health?

2. Define Environmental Ethic.
3. How Industries play their role in polluting the environment?
4. What is the necessity of pollution control? What are all the different organizations you know, which deal with pollution control?
5. List out the different types of pollutions caused by a Chemical / Textile / Leather / Automobile / Cement factory.
6. What is meant by Hazardous waste?
7. Define Industrial waste management.
8. Differentiate between garbage, rubbish, refuse and trash based on their composition and source.
9. Explain briefly how the quantity of solid waste generated in an industry could be reduced.
10. What are the objectives of treatments of solid wastes before disposal?
11. What are the different methods of disposal of solid wastes?

B. DISASTER MANAGEMENT

1. What is meant by Disaster Management? What are the different stages of Disaster management?
2. Differentiate Natural Disasters and Man made Disasters with examples.
3. Describe the necessity of Risk identification and Assessment Surveys while planning a project.
4. What is Disasters recovery and what does it mean to an Industry?
5. What are the factors to be considered while planning the rebuilding works after a major disaster due to flood / cyclone / earthquake? (Any one may be asked)
6. List out the public emergency services available in the state, which could be approached for help during a natural disaster.
7. Specify the role played by an Engineer in the process of Disaster management.
8. What is the cause for Earthquakes? How they are measured? Which parts of India are more vulnerable for frequent earthquakes?
9. What was the cause for the Tsunami 2004 which inflicted heavy loss to life and property along the coast of Tamilnadu? Specify its epicenter and magnitude.
10. Specify the Earthquake Hazard Zones in which the following towns of Tamil Nadu lie:
    (a) Chennai (b) Nagapattinam (c) Coimbatore (d) Madurai (e) Salem.
11. Which parts of India are experiencing frequent natural calamities such as (a) heavy rain fall (b) huge losses due to floods (c) severe cyclones