

**SANKAR POLYTECHNIC COLLEGE  
(AUTONOMOUS)**

**SANKAR NAGAR – 627357**



**DIPLOMA IN MECHANICAL ENGINEERING**

**N – SCHEME (FULL TIME)**

**2020-2021 ONWARDS**

**CURRICULUM OUTLINE**  
**Diploma in Mechanical Engineering (Full Time)**  
**N - Scheme**

**III - SEMESTER**

Subject Code	Subject	Hours per Week		
		Theory Hours	Practical Hours	Total Hours
N - 531	Engineering Mechanics and Mechanics of Materials	6	--	6
N - 532	Manufacturing Technology	5	--	5
N - 533	Fluid Mechanics and Hydraulic Machines	5	--	5
N - 534	Computer Aided Machine Drawing Practical	--	5	5
N - 535	Material Testing and Fluid Mechanics Practical	--	4	4
N - 536	Manufacturing Technology Practical	--	4	4
N - 537	Lathe Practical	--	5	5
	Seminar	1	--	1
	Total Hours	17	18	35

**IV - SEMESTER**

Subject Code	Subject	Hours per Week		
		Theory Hours	Practical Hours	Total Hours
N - 541	Applied Thermodynamics	6	--	6
N - 542	Machineshop Technology	5	--	5
N - 543	Metrology and Measuring Instruments	5	--	5
N - 544	Electrical Drives and Control	6	--	6
N - 545	Machineshop Technology Practical	--	4	4
N - 546	Metrology and Metallography Practical	--	4	4
N - 547	Electrical Drives and Control Practical	--	4	4
	Seminar	1	--	1
	Total Hours	23	12	35

**CURRICULUM OUTLINE**  
**Diploma in Mechanical Engineering (Full Time)**

**N - Scheme**

**V - SEMESTER**

Subject Code	Subject	Hours per Week		
		Theory Hours	Practical Hours	Total Hours
N - 551	Design of machine elements	6	--	6
N - 552	Thermal Engineering	6	--	6
N - 553	Renewable Energy sources and Energy Conservation	5	--	5
<b>ELECTIVE THEORY - I</b>				
N - 5541	Advanced Machining Process	5	--	5
N - 5542	Press Tools	5	--	5
N - 5543	Total Quality Management	5	--	5
N - 555	Thermal Engineering Practical	--	4	4
N - 556	Industrial Automation Practical	--	4	4
N - 557	Life and Employability Skill Practical	--	4	4
	Seminar	1	--	1
	Total Hours	23	12	35

**VI - SEMESTER**

Subject Code	Subject	Hours per Week		
		Theory Hours	Practical Hours	Total Hours
N - 561	Industrial Engineering and Management	6	--	6
N - 562	Computer Integrated Manufacturing	5	--	5
<b>ELECTIVE THEORY - II</b>				
N - 5631	Automobile Engineering	5	--	5
N - 5632	Robotics and Automation	5	--	5
N - 5633	Refrigeration and Air Conditioning	5	--	5
N - 564	Computer Integrated Manufacturing Practical	--	4	4
N - 565	Machine Tool Testing and Maintenance Practical	--	4	4
<b>ELECTIVE PRACTICAL - II</b>				
N - 5661	Automobile Engineering Practical	--	4	4

N - 5662	Robotics and Automation Practical	--	4	4
N - 5663	Refrigeration and Air Conditioning Practical	--	4	4
N - 567	Project Work	--	6	6
	Seminar	1	--	1
	Total Hours	17	26	35

**N - SCHEME**

(Implemented from the Academic Year 2019-2020 onwards)

Course Name : **DIPLOMA IN MECHANICAL ENGINEERING**Subject Code : **N - 531**Semester : **III**Subject Title : **ENGINEERING MECHANICS AND MECHANICS OF MATERIALS****TEACHING AND SCHEME OF EXAMINATIONS:**

Number of Weeks per Semester: 14

SUBJECT	INSTRUCTIONS		EXAMINATIONS			DURATION
	Hrs / Week	Hrs / Sem	MARKS			
ENGINEERING MECHANICS AND MECHANICS OF MATERIALS	6	84	INTERNAL ASSESSMENT	BOARD EXAMINATION	TOTAL	3 Hrs
			25	100*	100	

\* Examination will be conducted for 100 Marks and it will be reduced to 75 Marks

**TOPICS AND ALLOCATION OF HOURS:**

UNIT NO	TOPICS	HOURS
I	STATICS & KINEMATICS OF PARTICLES	17
II	DEFORMATION OF METALS	17
III	GEOMETRICAL PROPERTIES OF SECTIONS AND THIN SHELLS	17
IV	BEAMS AND THEORY OF SIMPLE BENDING	16
V	THEORY OF TORSION, SPRINGS AND FRICTION	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.

**N 531 - ENGINEERING MECHANICS AND MECHANICS OF MATERIALS  
DETAILED SYLLABUS**

**UNIT I**

**STATICS & KINEMATICS 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 - Kinematics-definition-types of plane motion-characteristics of kinematics-Rectilinear motion-Equation of motion in a straight line-simple problems only.

**UNIT II**

**(17)**

**DEFORMATION OF METALS:**

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

**UNIT III**

**(17)**

**GEOMETRICAL PROPERTIES OF SECTIONS AND THIN SHELLS:**

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, 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 section- Definition-Polar moment of Inertia-radius of gyration – Problems computing moment of inertia and radius of gyration for angle, T, 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.

#### **UNIT IV**

**(16)**

##### **BEAMS AND THEORY OF SIMPLE BENDING:**

Support reaction - types of support - removal of two dimensional supports – Simple problems only. 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.

#### **UNIT V**

**(16)**

##### **THEORY OF TORSION, SPRINGS AND FRICTION:**

Theory of torsion – Assumptions – torsion equation– 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. Friction - Introduction - Definition - Force of friction - Limiting friction – Static friction - Dynamic friction - Angle of friction - coefficient of friction - Laws of static and dynamic friction.

##### **Text Books:**

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

##### **Reference Books:**

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

**N - SCHEME**

(Implemented from the Academic Year 2019-2020 onwards)

Course Name : **DIPLOMA IN MECHANICAL ENGINEERING**Subject Code : **N - 532**Semester : **III**Subject Title : **MANUFACTURING TECHNOLOGY****TEACHING AND SCHEME OF EXAMINATIONS:**

Number of Weeks per Semester: 14 Weeks

SUBJECT	INSTRUCTIONS		EXAMINATIONS			DURATION
	Hrs / Week	Hrs / Sem	MARKS			
MANUFACTURING TECHNOLOGY	5	70	INTERNAL ASSESSMENT	BOARD EXAMINATION	TOTAL	3 Hrs
			25	100*	100	

\* Examination will be conducted for 100 Marks and it will be reduced to 75 Marks

**TOPICS AND ALLOCATION OF HOURS:**

UNIT NO	TOPICS	HOURS
I	FOUNDRY TECHNOLOGY	14
II	WELDING AND ADVANCED WELDING TECHNIQUES	14
III	METAL FORMING PROCESS AND METALLURGY	14
IV	LATHE AND SEMI AUTOMATIC LATHE	13
V	POWDER METALLURGY AND THEORY OF METAL CUTTING	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 personal 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 of powder metallurgy.
- Study about the metal cutting tools.

**N 532 - MANUFACTURING TECHNOLOGY  
DETAILED SYLLABUS**

**UNIT-I**

**FOUNDRY TECHNOLOGY: (14)**

**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 of moulding 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– types of core-core sand preparation – core binders – core boxes - CO<sub>2</sub> process of core making.

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

**Casting:** Pressure die casting – hot chamber die casting – cold chamber die casting – gravity die casting – centrifugal casting – continuous casting - defects in casting – causes and remedies.

**UNIT- II**

**WELDING AND ADVANCED WELDING TECHNIQUES: (14)**

**Arc welding process:** Definition–arc welding equipment–electrode types – 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 process:** 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.

**UNIT-III**

**METAL FORMING PROCESS AND METALLURGY: (14)**

**Forging:** Hot working, cold working–advantages of hot working and cold working– hot working operations – rolling, forging, and smith forging: Upsetting-Drawing down-Bending-Punching-Forge welding-- 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.

**Metallurgy:**–Introduction- Allotropy of iron--Micro structure of steel--Iron-carbon diagram.

#### UNIT-IV

##### LATHE AND SEMI AUTOMATIC LATHE:

(13)

**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 – 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 – Collets-Jaw chucks-Fixtures . Tool holders – Straight cutter tool holder-Adjustable angle cutter holder-Multiple cutter holder-Knee tool holder.

#### UNIT-V

##### POWDER METALLURGY AND THEORY OF METAL CUTTING

(13)

**Powder metallurgy:** Methods of manufacturing metal powders --atomization, reduction and electrolysis deposition – compacting – cold pressing, hot pressing--sintering – sintering furnace, sizing, infiltration – mechanical properties of parts made by powder metallurgy – strength, ductility, hardness , dampness-- design rules for the power metallurgy process-advantage, disadvantage and application of powder metallurgy.

**Study of tools:** Introduction of metal cutting–orthogonal cutting– oblique cutting – comparison between orthogonal cutting and oblique cutting-- single point cutting tool – nomenclature – types of chips –continuous chips-discontinuous chips and continuous chips with built-- chip breakers – step type- groove type-clamp type --cutting tool materials –carbon steels-high speed steel- satellites- cemented carbides- ceramics-- properties – tool wears – factors affecting tool life – cutting fluids – cutting fluids functions – properties of cutting fluid.

##### Text Books:

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

**Reference Books:**

1. Production Technology, Edn. XII, Khanna Publishers, 2-B, North Market, NAI Sarak, New Delhi 110 006 – 2006
2. Production Technology - P. C. SHARMA - Edn. X - S.Chand & Co. Ltd., Ram Nagar, New Delhi 110 055 – 2006
3. Production Technology – HMT - Edn. 18 - published by Tata McGraw Hill publishing Co. Ltd., 7 West Patel nagar, New Delhi 110 008. – 2001.
4. Manufacturing process – Begeman - 5th Edition -McGraw Hill, New Delhi 1981.
5. Workshop Technology- WAJ Chapman - Volume I, II, & III – Vima Books Pvt. Ltd., 4262/3, Ansari Road, Daryaganj, New Delhi 110 002.
6. Workshop Technology – Raghuwanshi - Khanna Publishers. Jain & Gupta.

**N - SCHEME**

(Implemented from the Academic Year 2019-2020 onwards)

Course Name : **DIPLOMA IN MECHANICAL ENGINEERING**Subject Code : **N - 533**Semester : **III**Subject Title : **FLUID MECHANICS AND HYDRAULIC MACHINES****TEACHING AND SCHEME OF EXAMINATIONS:**

No. of Weeks per

Semester: 14

SUBJECT	INSTRUCTIONS		EXAMINATIONS			DURATION
	Hrs / Week	Hrs / Sem	MARKS			
FLUID MECHANICS AND HYDRAULIC MACHINES	5	70	INTERNAL ASSESSMENT	BOARD EXAMINATION	TOTAL	3 Hrs
			25	100*	100	

\* Examination will be conducted for 100 Marks and it will be reduced to 75 Marks

**TOPICS AND ALLOCATION OF HOURS:**

UNIT NO	TOPICS	HOURS
I	PROPERTIES OF FLUIDS AND PRESSURE MEASUREMENTS	14
II	FLOW OF FLUIDS	14
III	FLOW THROUGH PIPES, IMPACT OF JETS AND HYDRAULIC TURBINES	14
IV	CENTRIFUGAL AND RECIPROCATING PUMPS	13
V	HYDRAULIC SYSTEMS	13
	TEST AND REVISION	7
	TOTAL	75

**RATIONALE:**

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

**OBJECTIVES:**

- Define the properties of Fluids.
- Explain the working of pressure measuring devices.
- Define the concept of Total pressure and Centre of pressure on immersed bodies.
- Explain continuity equation and Bernoulli's Theorem.
- Assess the impact of frictional loss of head in flow through pipes.
- Estimate the discharge through orifices and mouthpiece.
- Distinguish the working principles of pumps and turbines.
- Explain the working of centrifugal pumps and reciprocating pumps.
- State the properties of hydraulic fluid.
- Develop hydraulic circuit for machine tool applications.

**N 533 - FLUID MECHANICS AND HYDRAULIC MACHINES  
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 – Piezo meter 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.

Hydrostatic forces – Concept of Total pressure and centre of pressure on immersed bodies (Definition only).

**UNIT II**

**(14)**

**FLOW OF FLUIDS:**

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 co-efficient – problems – discharge through a small orifice discharging freely only – problems – experimental method of finding  $C_v$ ,  $C_c$  and  $C_d$  – Flow through Mouthpiece (Definition and types only).

**UNIT III**

**(14)**

**FLOW THROUGH PIPES, IMPACT OF JET AND HYDRAULIC TURBINES:**

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.

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.

Layout of hydro electric power plant – 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.

## UNIT IV

(13)

### **CENTRIFUGAL AND RECIPROCATING PUMPS:**

Centrifugal Pumps – classifications – construction and working of single stage centrifugal pumps - components with types – multi stage pumps – advantages – priming – cavitation – manometric head – work done – manometric efficiency – overall efficiency – Problems.

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 – negative slip – problems – indicator diagram – separation – air vessel (functions and working).

Special pumps – Jet pump – Turbine pump – Submersible pump.

## UNIT V

(13)

### **HYDRAULIC SYSTEMS:**

Hydraulic system – Definition – Elements of hydraulic system – Merits and demerits – Service properties of hydraulic fluids – Hydraulic accumulators – Dead weight or 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 – 2/2 DCV, 3/2 DCV, 4/2 DCV, 4/3 DCV, 5/2 DCV and 5/3 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.

### **Text Books:**

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

## N - SCHEME

(Implemented from the Academic Year 2019-2020 onwards)

Course Name : **DIPLOMA IN MECHANICAL ENGINEERING**

Subject Code : **N - 534**

Semester : **III**

Subject Title : **COMPUTER AIDED MACHINE DRAWING PRACTICAL**

### TEACHING AND SCHEME OF EXAMINATIONS:

Number of Weeks per Semester: 14

SUBJECT	INSTRUCTIONS		EXAMINATIONS			DURATION
	Hrs / Week	Hrs / Sem	MARKS			
COMPUTER AIDED MACHINE DRAWING PRACTICAL	5	70	INTERNAL ASSESSMENT	BOARD EXAMINATION	TOTAL	3 Hrs
			25	100*	100	

\* Examination will be conducted for 100 Marks and it will be reduced to 75 Marks

### 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.

### CAD EXERCISES:

Detailed drawing of following machine parts is to be given to students. Draw the assembled views (two views only) and bill of materials

#### 2D Drawing

Sleeve & Cotter joint

Knuckle Joint

Plummer block

Machine vice

Flange Coupling

#### 3D Drawing

Geneva Wheel

Connecting rod

Screw Jack

### Machine Drawing

Fit-Classification of fits-Tolerances-Allowances-Fasteners-bolts-nuts-Types of Section – Full Section-revolved section-offset section.

## N - SCHEME

(Implemented from the Academic Year 2019-2020 onwards)

Course Name : **DIPLOMA IN MECHANICAL ENGINEERING**

Subject Code : **N - 535**

Semester : **III**

Subject Title : **MATERIAL TESTING AND FLUID MECHANICS PRACTICAL**

### TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 14

SUBJECT	INSTRUCTIONS		EXAMINATIONS			DURATION
	Hrs / Week	Hrs / Sem	MARKS			
MATERIAL TESTING AND FLUID MECHANICS PRACTICAL	4	56	INTERNAL ASSESSMENT	BOARD EXAMINATION	TOTAL	3 Hrs
			25	100*	100	

\* Examination will be conducted for 100 Marks and it will be reduced to 75 Marks

### OBJECTIVES:

- 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 a 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:  
Double shear test on M.S. bar to finding the resistance of material to shear load.
7. Deflection Test on Beams  
Determination of Young's modulus for wooden beam by deflection test.

**Fluid mechanics laboratory exercises:**

1. Verify the Bernoulli's Theorem.
2. Determination of co-efficient of discharge of a mouth piece by variable head method.
3. Determination of co-efficient of discharge of an orifice by variable head method.
4. Determination of co-efficient of discharge of a venturimeter.
5. Determination of co-efficient of discharge of an orifice meter.
6. Determination of friction factor in a pipe.
7. Performance test on reciprocating pump / centrifugal pump and to draw the characteristic curves.
8. Performance test on impulse turbine / reaction turbine and to find out the efficiency.

## N – SCHEME

(Implemented from the Academic Year 2019-2020 onwards)

Course Name : **DIPLOMA IN MECHANICAL ENGINEERING**

Subject Code : **N - 536**

Semester : **III**

Subject Title : **MANUFACTURING TECHNOLOGY PRACTICAL**

### TEACHING AND SCHEME OF EXAMINATIONS:

Number of Weeks per Semester: 14

SUBJECT	INSTRUCTIONS		EXAMINATIONS			DURATION
	Hrs / Week	Hrs / Sem	MARKS			
MANUFACTURING TECHNOLOGY PRACTICAL	4	56	INTERNAL ASSESSMENT	BOARD EXAMINATION	TOTAL	3 Hrs
			25	100*	100	

\* Examination will be conducted for 100 Marks and it will be reduced to 75 Marks

### OBJECTIVES

- 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

1. Bent Pipe with core print
2. T-pipes with core print
3. Tumbles

### Loose Piece Pattern

1. Dovetail

## **Core preparation**

1. Core preparation for Bent pipe / T-pipe

## **Welding Section**

- Introduction of Safety in welding shop
- Introduction to hand tools and equipment
- Arc and gas welding equipment
- Types of joints

### **Exercises:**

Make the following welding joint.

### **Arc welding** (Raw Material: 50 mm x 3mm MS flat)

1. Butt joint
2. Lap joint
3. Corner joint
4. T – Joint

### **Gas Welding** (Raw Material: 25mm x 3mm Ms flat)

Corner joint

### **Gas cutting:** (MS Flat – 50mm X 6mm thickness)

Profile - Straight cutting

### **Spot welding:** (GI/MS Sheet)

Lap joint.

## N - SCHEME

(Implemented from the Academic Year 2019-2020 onwards)

Course Name : **DIPLOMA IN MECHANICAL ENGINEERING**

Subject Code : **N - 537**

Semester : **III**

Subject Title : **LATHE PRACTICAL**

### TEACHING AND SCHEME OF EXAMINATIONS:

Number of Weeks per Semester: 14

SUBJECT	INSTRUCTIONS		EXAMINATIONS			DURATION
	Hrs / Week	Hrs / Sem	MARKS			
LATHE PRACTICAL	5	70	INTERNAL ASSESSMENT	BOARD EXAMINATION	TOTAL	3 Hrs
			25	100*	100	

\* Examination will be conducted for 100 Marks and it will be reduced to 75 Marks

### OBJECTIVES:

- Identify the parts of a lathe.
- Identify the work holding devices.
- Set the tools for various operations.
- Operate the lathe and machine a component using lathe.
- Identify the various tools and its holding devices.
- Identify the work holding devices.
- Prepare the record of work for the exercises.

### LATHE SECTION:

- Introduction of safety in operating machines.
- Study of lathe and its parts.
- Types of tools used in lathe work.
- Study of work holding devices and tool holding devices.
- Setting of work and tools.
- Operation of lathe.
- Practice on a lathe.
- Types of measuring instruments and their uses.

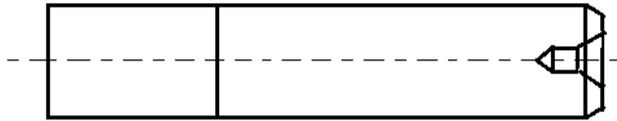
**Exercise:**

**Make the following jobs in the lathe. Raw material – 25mm MS Rod**

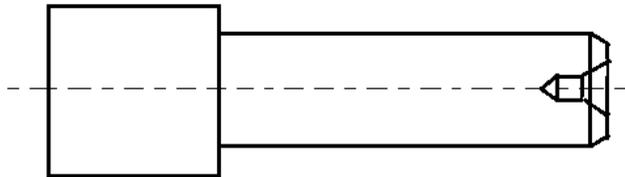
**Exercise No : 1 – Facing and chamfering**



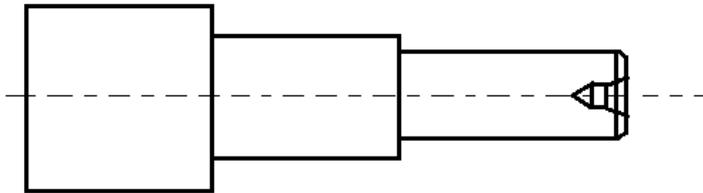
**Exercise No : 2 – Counter drilling**



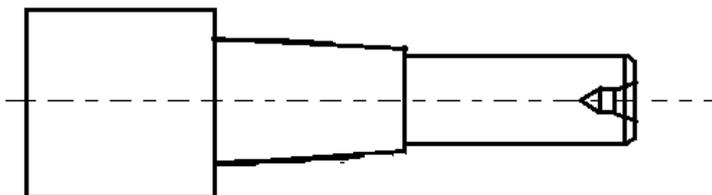
**Exercise No : 3 – Plain turning**



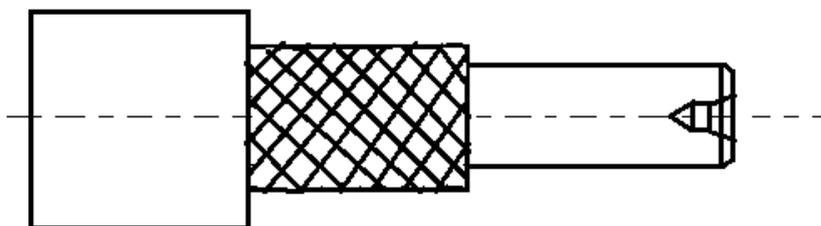
**Exercise No : 4 – Step turning**



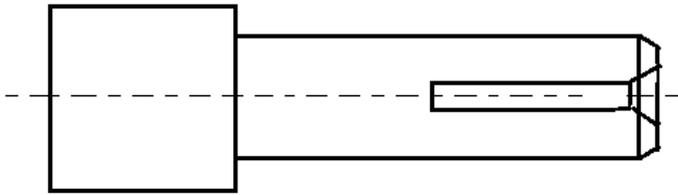
**Exercise No : 5 – Tapper turning**



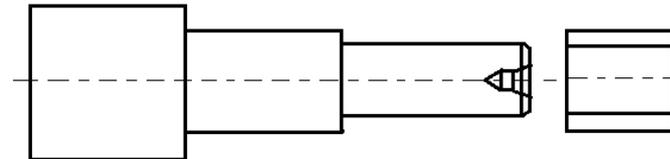
**Exercise No : 6 – Knurling**



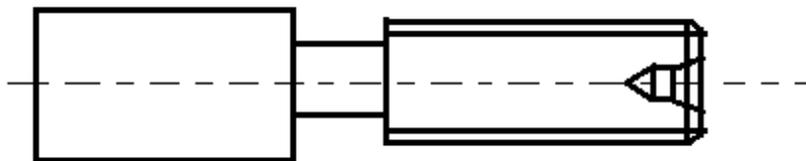
**Exercise No : 7 – Drilling**



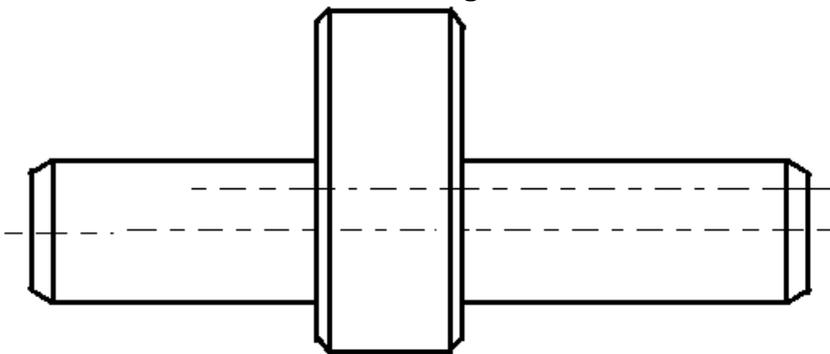
**Exercise No : 8** - Shaft and bush mating



**Exercise No : 9** - Thread cutting



**Exercise No : 10** - Eccentric turning



**N - SCHEME**

(Implemented from the Academic Year 2019-2020 onwards)

Course Name : **DIPLOMA IN MECHANICAL ENGINEERING**Subject Code : **N - 541**Semester : **IV**Subject Title : **APPLIED THERMODYNAMICS****TEACHING AND SCHEME OF EXAMINATIONS:**

Number of Weeks per Semester: 14

SUBJECT	INSTRUCTIONS		EXAMINATIONS			
	Hrs / Week	Hrs / Sem	MARKS			DURATION
APPLIED THERMODYNAMICS	6	84	INTERNAL ASSESSMENT	BOARD EXAMINATION	TOTAL	3 Hrs
			25	100*	100	

\* Examination will be conducted for 100 Marks and it will be reduced to 75 Marks.

**TOPICS AND ALLOCATION OF HOURS:**

UNIT NO	TOPICS	HOURS
I	BASICS OF THERMODYNAMICS AND THERMODYNAMIC PROCESSES 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:**

Engineering Thermodynamics is the first course on Thermal Science and Engineering. It studies various energy interactions notably heat and work transfer. It is based on certain laws of nature which are never seen to be violated. The knowledge on the concept of Thermodynamics, Thermodynamic Processes, Steady flow energy equation and steam properties and performance of Boilers are vital.

**OBJECTIVES:**

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

**N 541 - APPLIED THERMODYNAMICS  
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 temperature(isothermal) , Isentropic (reversible adiabatic) and, Polytropic Processes – p-V and T-s diagrams, work done, Change in internal energy, heat transfer, change in enthalpy, change in entropy for above processes – Simple problems.

**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 irreversible processes – assumptions in deriving air Standard efficiency – Carnot cycle – Otto cycle – Diesel cycle - Comparison of ideal and actual p-v diagrams of Otto and Diesel cycles – Simple problems.

**Fuels & Combustion:**-Classifications of fuels - merits and demerits – requirements of a good fuel – Octane number – detonation - Pre-ignition – Cetane number – Diesel knock – comparison of detonation and diesel knock- fuel additives – Stages of Combustion – Delay period – Variables affecting delay period – Methods of generating air swirl in diesel engine combustion chambers – Types of combustion Chambers –combustion equations – stoichiometric air required for complete combustion of fuels – excess air – products of combustion – analysis of 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 reciprocating compressor – compression processes – clearance volume and its effects – Volumetric efficiency – multi stage compression – merits and demerits – Two stage compressor with Imperfect cooling-

with perfect inter cooling – Centrifugal and axial flow air compressors – simple problems.

**Gas turbines:** – Uses - classifications – merits and demerits -constant pressure combustion gas turbine – gas turbine with intercooler, reheater, regenerator - effects – closed cycle gas turbines - merits and demerits – jet propulsion - turbojet engines – turbo propeller engines – ramjet – Working Principle - merits and demerits –Rocket engines – applications of rockets.

#### UNIT IV

(16)

#### FORMATION & PROPERTIES OF STEAM AND STEAM CALORIMETER

**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 of water – 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 – steam tables - Mollier chart.

**Expansion process of Steam:** Constant Volume process –Constant Pressure Process – Constant Temperature process –Hyperbolic Process – Isentropic process – Polytropic 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 – comparison of 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.

**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 Engineering, 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. Thermal Engineering, R.S.Khurmi and J.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, Dhanpat Rai & Sons New Delhi.
3. Applied Thermodynamics, Dom kundwar and .P.Kothanda raman, 2<sup>nd</sup> Edition, Khanna publishers, New Delhi.

## N - SCHEME

(Implemented from the Academic Year 2019-2020 onwards)

Course Name : **DIPLOMA IN MECHANICAL ENGINEERING**

Subject Code : **N - 542**

Semester : **IV**

Subject Title : **MACHINESHOP TECHNOLOGY**

### TEACHING AND SCHEME OF EXAMINATIONS:

Number of Weeks per Semester: 14 Weeks

SUBJECT	INSTRUCTIONS		EXAMINATIONS			DURATION
	Hrs / Week	Hrs / Sem	MARKS			
MACHINE SHOP TECHNOLOGY	5	70	INTERNAL ASSESSMENT	BOARD EXAMINATION	TOTAL	3 Hrs
			25	100*	100	

\* Examination will be conducted for 100 Marks and it will be reduced to 75 Marks.

### TOPICS AND ALLOCATION OF HOURS:

UNIT NO	TOPICS	HOURS
I	RECIPROCATING MACHINES	14
II	DRILLING AND BROACHING MACHINES	14
III	MILLING MACHINES AND GEAR GENERATING PROCESS	14
IV	ABRASIVE PROCESS	13
V	CNC MACHINE AND NON- CONVENTIONAL MACHINING PROCESSES	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 personal involved in production. This will provide the students an opportunity to skill themselves for the industrial scenario..

## **OBJCETIVES**

Explain the working of machine tools, planer, shaper and slotter.

- Compare various work holding devices.
- Explain the working of machine tools drilling machines and milling machines.
- Distinguish various types milling cutter
- Classify the different types of grinders and grinding wheels.
- Explain the various types of gear generating process.
- Appreciate the use of non conventional machining process.
- Explain the broaching and drilling operation.
- Study about the CNC machine.

**N 542 - MACHINE SHOP TECHNOLOGY  
DETAILED SYLLABUS**

**UNIT I RECIPROCATING MACHINES: (14)**

**Planer:** Introduction - description of double housing planer –specifications -principles of operation – drives - quick return mechanism - feed mechanism - work holding devices and special fixtures - types of tools - operations.

**Shaper:** Introduction – specifications – principles of operations standard shaper – quick return mechanism - crank and slotted link –hydraulic shaper - feed mechanism - work holding devices – fixture - operations.

**Slotter:** Introduction – specifications - method of operation –whit worth quick return mechanism - feed mechanism - work holding devices -types of tools.

**UNIT II DRILLING AND BROACHING MACHINES (14)**

**Drilling machines:** Drills –flat drills-twist drills- nomenclature- types of drilling machines- bench type-floor type-radial type-gang drill- multi spindle type –principle of operation in drilling –speeds and feeds for various materials- drilling holes-methods of holding drill bit-drill chucks-socket and sleeve –drilling –operation-remaining –counter boring –spot facing-tapping-deep hole drilling.

**Broaching:** Types of broaching machine - horizontal, vertical and continuous broaching - principles of operation - types of broaches –classification - broach tool nomenclature - broaching operations.

**UNIT III MILLING MACHINES AND GEAR GENERATING PROCESSING MACHINES:**

Types - column and knee type – plain – universal milling 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.

**Gear generating process:** gear shaper - gear hobbing - principle of operation only -- gear finishing processes: burnishing – shaving - grinding and lapping - gear materials- cast iron- steel-alloy steel-brass- bronze- aluminium and nylon.

**UNIT IV ABRASIVE PROCESS: (13)**

**Grinding machines:** Types and classification – specifications – rough grinding – pedestal grinders - portable grinders - belt grinders -precision grinding - cylindrical grinder – centerless grinders – surface grinder - tool and cutter grinder - planetary grinders - principles of operations.

**Grinding wheels:** abrasives - natural and artificial diamond wheels - types of bonds - grit, grade and structure of wheels -wheel shapes and sizes - standard marking systems of grinding wheels - selection of grinding wheel - mounting of grinding wheels - dressing and truing of wheels - balancing of grinding wheels.

**UNIT V CNC MACHINE AND NON- CONVENTIONAL MACHINING PROCESSES**

**CNC machines: (13)**

Numerical control – definition – working principle of a CNC system – features of CNC machines - advantage of CNC machines – difference between NC and CNC -- construction and working principle of machining centre – Coordinate Measuring

Machine – construction and working 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-application.

**Non-Conventional Machining Processes:** Construction, working and applications of ultrasonic machining - chemical machining – electrochemical grinding - electrical discharge machining - plasma arc machining - LASER machining - advantages – disadvantages.

#### **Text Books:**

1. Elements of Workshop Technology- Vol. I & II, Hajra Choudry & Battacharya, Edn.11, published by Media Promoters and Publishers Pvt. Ltd., Seervai Buildings `B', 20-G, Noshir Bharucha Marg, 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.

## N - SCHEME

(Implements from the Academic Year 2019-2020 onwards)

Course Name : **DIPLOMA IN MECHANICAL ENGINEERING**

Subject Code : **N - 543**

Semester : **IV**

Subject Title : **METROLOGY AND MEASURING INSTRUMENTS**

### TEACHING AND SCHEME OF EXAMINATIONS:

Number of Weeks per Semester: 14 Weeks

SUBJECT	INSTRUCTIONS		EXAMINATIONS			DURATION
	Hrs / Week	Hrs / Sem	MARKS			
METROLOGY AND MEASURING INSTRUMENTS	5	70	INTERNAL ASSESSMENT	BOARD EXAMINATION	TOTAL	3 Hrs
			25	100*	100	

\* Examination will be conducted for 100 Marks and it will be reduced to 75 Marks.

### TOPICS AND ALLOCATION OF HOURS:

UNIT NO	TOPICS	HOURS
I	INTRODUCTION TO MEASUREMENT	14
II	STRAIN GAUGE AND TRANSDUCER	14
III	APPLIED MECHANICAL MEASUREMENT	14
IV	ANGULAR MEASUREMENT	13
V	MACHINE TOOL TESTING	13
	TEST AND REVISION	7
	TOTAL	75

### OBJECTIVES:

- To Study Advances in technology, Measurement Techniques, Types of instrumentation devices, Innovations.
- To study the principle of Instrumentation, transducers and measurement of Non Electrical Parameters.

**N 543 - METROLOGY AND MEASURING INSTRUMENTS  
DETAILED SYLLABUS**

**UNIT I** **(14)**

**INTRODUCTION TO MEASUREMENT:**

Definition of measurement, Methods of measurement: Direct and Indirect, Standards of Measurement, Factors influencing selection of measuring instruments

Precision and accuracy, Sensitivity and repeatability, Range, Threshold, Hysteresis, Calibration, Calibration of errors.

**Measuring Instrument:** Thread measurement, Limit gauge, Surface roughness tester

**UNIT II** **(14)**

**STRAIN GAUGE AND TRANSDUCER:**

Introduction to Transducers, Classification of Transducer, Strain measurement: Strain Gauge, Classification, Mounting of Strain gauges measurement of force, torque, Pressure: Force measurement: Spring balance, Load cell. Torque measurement: Prony brake, Eddy current, Hydraulic dynamo Meter, Pressure measurement: Mcloed gauge.

**UNIT III** **(14)**

**APPLIED MECHANICAL MEASUREMENT:**

Speed Measurement: Classification of tachometers. Displacement measurement: Linear variable Differential transformers (LVDT), Flow measurement: Roto meter, Turbine meter. Temperature measurement: Resistance thermo meter, Optical pyro meter Density measurement: Hydro meter. Liquid level measurement: Float gauge.

**UNIT IV** **(13)**

**ANGULAR MEASUREMENT:**

Basics of limits, Fit, Tolerance concept of angular measurement, Instruments, Instruments for angular measurement: Working and use of universal bevel protractor, Sprit level. Principle of working of clinometers, Angle gauges. Screw thread measurement: ISO Grade and fix of thread: Errors in thread: Pitch errors, Measurement of major diameter and minor diameter, effective diameter, pitch. Thread gauge micrometer, working principle of floating carriage dial micro meter.

**UNIT V** **(13)**

**MACHINE TOOL TESTING:**

Parallelism, Straightness, Squireness, coaxiality, Roundness, Runout, Alignment of testing of Machine tool as per IS Standard. Analytical and functional inspection, Measurement of tooth thickness (Constant chord method), Gear tooth vernier, Errors in gears.

**Text Books:**

1. Engineering Metrology – R.K.Jain, Khanna Publishers, New Delhi.
2. A Text Book of Engineering Metrology – I.C.Gupta.

**Reference Books:**

1. Principles of Engineering Metrology – Rega Rajendra.
2. Engineering Metrology – K.J.Hume, kalyani Publishers,

## N - SCHEME

(Implemented from the Academic Year 2019-2020 onwards)

Course Name : **DIPLOMA IN MECHANICAL ENGINEERING**

Subject Code : **N -544**

Semester : **IV**

Subject Title : **ELECTRICAL DRIVES AND CONTROL**

### TEACHING AND SCHEME OF EXAMINATIONS:

Number of Weeks per Semester: 14

SUBJECT	INSTRUCTIONS		EXAMINATIONS			DURATION
	Hrs / Week	Hrs / Sem	MARKS			
ELECTRICAL DRIVES AND CONTROL	6	84	INTERNAL ASSESSMENT	BOARD EXAMINATION	TOTAL	3 Hrs
			25	100*	100	

\* Examination will be conducted for 100 Marks and it will be reduced to 75 Marks.

### TOPICS AND ALLOCATION OF HOURS:

UNIT NO	TOPICS	HOURS
I	DC MACHINES	17
II	AC MACHINES	17
III	STEPPER AND SERVO MOTOR & 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.

**N 544 - ELECTRICAL DRIVES AND CONTROL  
DETAILED SYLLABUS**

**UNIT I** **(17)**  
**DC MACHINES**

**Basics :** Definition - Electric current, voltage and resistance - Ohm's law and Kirchhoff'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, and Faraday's law of electromagnetic induction, electrical and mechanical units.

**DC generators:** Construction, principle of operation, types and application.

**DC motors:** Construction, principle of operation, types and application.

**Starter:** Necessity of starters: Three point, four point starters.

**UNIT II** **(17)**  
**AC MACHINES**

**Basics:** Fundamentals of AC voltage, and current – peak, average, RMS value of sine wave, frequency, time period, amplitude, power and power factor (definition only)- star and delta connection relationship between phase, line voltage and current in star and delta connections.

**Transformer:** Construction and principle of operation – EMF equation (no definition)- losses in Transformer – efficiency – application.

**AC machine:** Single Phase Induction Motor - Single phase capacitor start induction motor and universal motor (construction and working principle only) - applications - Three phase induction motors – Squirrel cage and slip ring Induction motors (construction and working principle only) - application – speed control of 3 $\Phi$  Induction motor. Alternator: construction – principle of operation – types and applications.

**Starter:** Necessity of starters – DOL and star/delta starter.

**UNIT III** **(17)**  
**STEPPER AND SERVO MOTORS & DRIVES:**

PMDC, Stepper motor- construction and working principle and applications - Servo motor – types: brushless servo motor, permanent magnet 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**

**Power Supplies:** Diode – terminals: anode and cathode, forward biasing and reverse biasing – use of diode in rectifiers – half wave and full wave – necessity of filters- Regulated power supplies: IC voltage regulators – SMPS, UPS and Inverters and their applications.

**Display devices** – LED – Construction and Working Principle, 7 segments LED – Common Anode Type and Common Cathode type.

**Logic 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**

**Control Elements : 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 Circuit breaker (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.

## N - SCHEME

(Implemented from the Academic Year 2019-2020 onwards)

Course Name : **DIPLOMA IN MECHANICAL ENGINEERING**

Subject Code : **N - 545**

Semester : **IV**

Subject Title : **MACHINESHOP TECHNOLOGY PRACTICAL**

### TEACHING AND SCHEME OF EXAMINATIONS:

Number of Weeks per Semester: 14

SUBJECT	INSTRUCTIONS		EXAMINATIONS			
	Hrs / Week	Hrs / Sem	MARKS			DURATION
MACHINE SHOP TECHNOLOGY PRACTICAL	4	56	INTERNAL ASSESSMENT	BOARD EXAMINATION	TOTAL	3 Hrs
			25	100*	100	

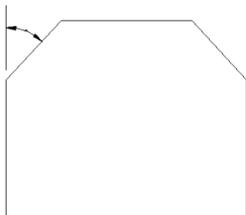
\* Examination will be conducted for 100 Marks and it will be reduced to 75 Marks.

### OBJECTIVES

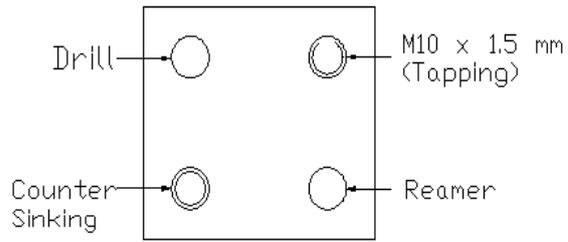
- Identify a milling machine and its parts
- Identify a cylindrical grinder, surface grinder and tool and cutter grinder
- Identify shaper, Slotter and its parts
- Identify the tools and instruments used in milling.
- Handle the different types of work holding devices
- Machine a component using different 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 Materials: Cast Iron/ Mild Steel

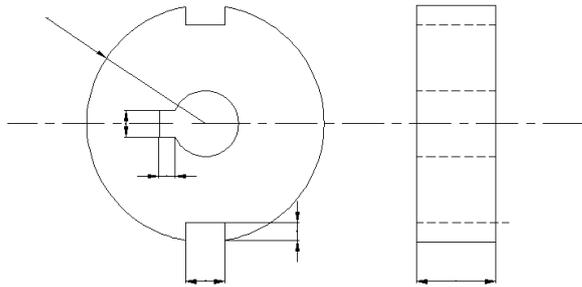
1. Make inclined surfaces by using shaping machine



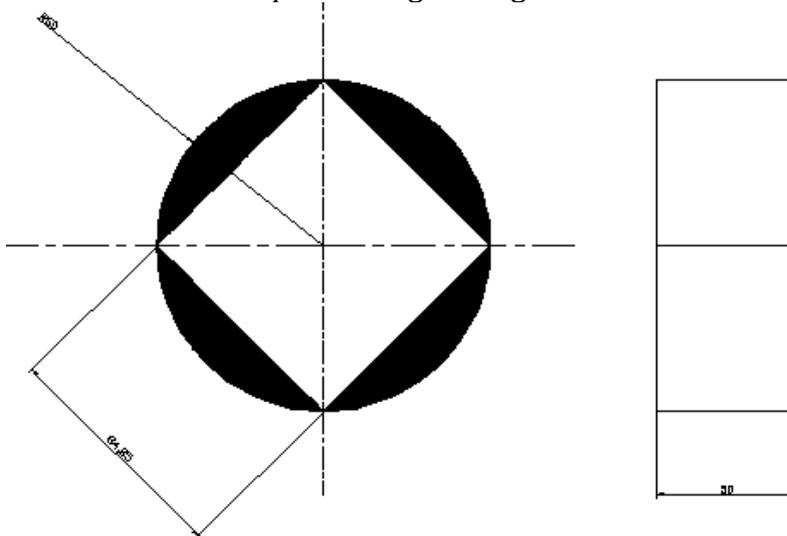
2. Make a drilling, reaming, tapping & counter sinking by using Radial drilling machine



3. Make Groove cuts using slotting machine



4. Make round to square using milling machine



5. Make a spur Gear using milling machine by differential Indexing.

Following data:

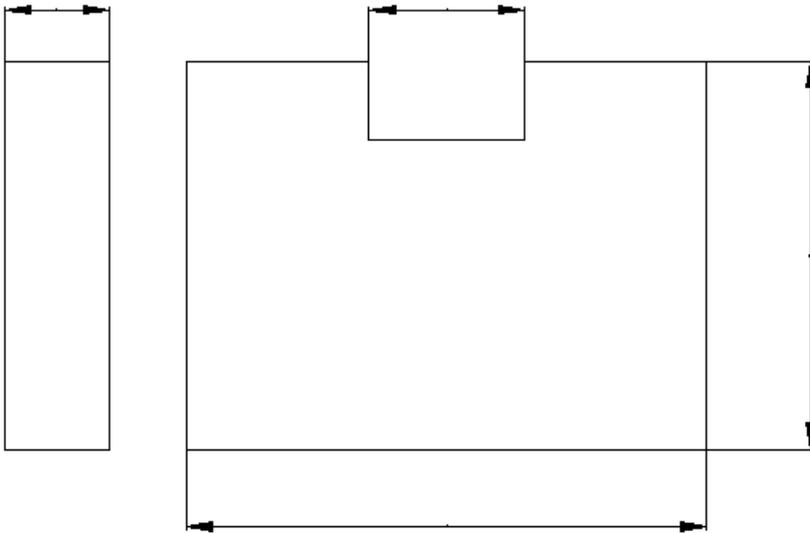
- Number of teeth :
- Module / DP :
- Pressure angle :
- Cutter Thickness :

6. Make a Spur rack & helical rack using milling machine

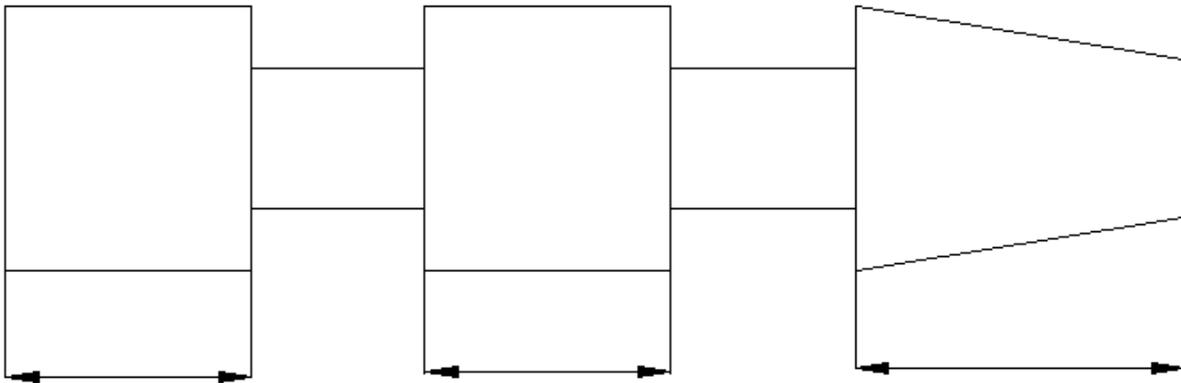
Following data:

Number of teeth :  
 Module / DP :  
 Lead of Helices :  
 Pitch of Lead Screw :  
 Pressure angle :  
 Cutter Thickness :

7. Make a slot cut using milling machine.



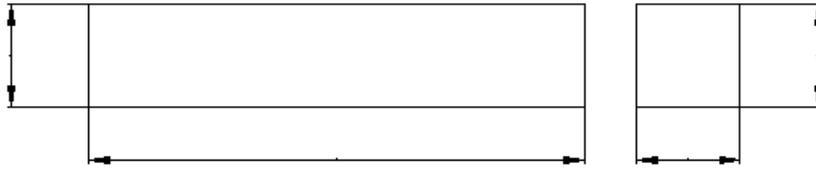
8. Make a plain and taper grinding by using cylinder grinding machine



9. Make a Facing Tool using Tool and Cutter Grinder following data

1. Top rake angle -  $6^{\circ}$
2. Side rake angle -  $6^{\circ}$
3. Front clearance angle -  $8^{\circ}$
4. Side clearance angle -  $8^{\circ}$
5. Front cutting edge angle -  $10^{\circ}$
6. Side cutting edge angle -  $10^{\circ}$

10. Make a Plain Surfaces (Four surface) to an accuracy of 0.01mm by using surface Grinding machine.



## N - SCHEME

(Implemented from the Academic Year 2019-2020 onwards)

Course Name : **DIPLOMA IN MECHANICAL ENGINEERING**

Subject Code : **N - 546**

Semester : **IV**

Subject Title : **METROLOGY AND METALLAGRAPHY PRACTICAL**

### TEACHING AND SCHEME OF EXAMINATIONS:

Number of Weeks per Semester: 14

SUBJECT	INSTRUCTIONS		EXAMINATIONS			DURATION
	Hrs / Week	Hrs / Sem	MARKS			
METROLOGY AND METALLAGRAPHY PRACTICAL	4	56	INTERNAL ASSESSMENT	BOARD EXAMINATION	TOTAL	3 Hrs
			25	100*	100	

\* Examination will be conducted for 100 Marks and it will be reduced to 75 Marks.

### OBJECTIVES:

- 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:**

- To study the micro structure of the metals using Metallurgical Microscope
- Conduct the liquid penetration test to find the crack.
- Conduct magnetic particle test to find cracks.

**Exercises:**

1. Find the grain structure of the given specimen using the Metallurgical Microscope.
2. Detect of cracks in specimen using Die penetration test.
3. Detect the Cracks in the specimen using Visual Inspection and ring test
4. Detect the cracks in specimen using Magnetic particle test.

## N - SCHEME

(Implemented from the Academic Year 2019-2020 onwards)

Course Name : **DIPLOMA IN MECHANICAL ENGINEERING**

Subject Code : **N - 547**

Semester : **IV**

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

### TEACHING AND SCHEME OF EXAMINATIONS:

Number of Weeks per Semester: 14

SUBJECT	INSTRUCTIONS		EXAMINATIONS			DURATION
	HOURS / WEEK	HOURS / SEMESTER	MARKS			
ELECTRICAL DRIVES AND CONTROL PRACTICAL	4	56	INTERNAL ASSESSMENT	BOARD EXAMINATION	TOTAL	3 Hrs
			25	100*	100	

\* Examination will be conducted for 100 Marks and it will be reduced to 75 Marks.

### OBJECTIVES

- Identify starters for different motors.
- Study and prepare earthing
- Test the characteristics of DC and AC machines.
- Identify and select controlling elements.
- Explore the performance of ELCB, MCB.
- Design regulated power supplies.
- Identify display devices - LED, 7 segment LED, LCD.
- Identify the drive circuit for special motors.
- 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.

## N - SCHEME

(Implemented from the Academic Year 2019-2020 onwards)

Course Name : **DIPLOMA IN MECHANICAL ENGINEERING**

Subject Code : **N - 551**

Semester : **V**

Subject Title : **DESIGN OF MACHINE ELEMENTS**

### TEACHING AND SCHEME OF EXAMINATIONS:

Number of Weeks per Semester: 14

SUBJECT	INSTRUCTIONS		EXAMINATIONS			DURATION
	Hrs / Week	Hrs / Sem	MARKS			
DESIGN OF MACHINE ELEMENTS	6	84	INTERNAL ASSESSMENT	BOARD EXAMINATION	TOTAL	3 Hrs
			25	100*	100	

\* Examination will be conducted for 100 Marks and it will be reduced to 75 Marks.

### TOPICS AND ALLOCATION OF HOURS:

UNIT NO	TOPICS	HOURS
I	ENGINEERING MATERIALS AND DESIGN OF JOINTS	17
II	DESIGN OF SHAFT, COUPLING AND KEY	17
III	DESIGN OF FLAT AND V BELT AND HELICAL SPRING	17
IV	DESIGN OF BEARINGS AND FASTENERS	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.

**N 551 - DESIGN OF MACHINE ELEMENTS  
DETAILED SYLLABUS**

**UNIT I** **(17)**

**ENGINEERING MATERIALS AND DESIGN OF JOINTS**

**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.

**UNIT II** **(17)**

**DESIGN OF SHAFT, COUPLING AND KEY**

**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 AND V BELT AND HELICAL SPRING**

**Flat Belts:** Types of belts - materials for belt -- types of belt drives – Speed ratio – effect of slip - length 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.

**Design of spring:** Classification and Application of Spring – Spring Terminology – Spring Materials and Specifications – Design of Helical - Problem

**UNIT IV** **(16)**

**DESIGN OF BEARINGS AND FASTENERS**

**Bearings:** Classifications of bearings – sliding contact and rolling contact bearings - radial and thrust bearings - roller bearing – journal bearings - heat generated - heat dissipated - cooling oil requirement – problems - design of journal bearings only – Problems. Design based on approved data books only.

**Fasteners:** Design of bolted joints - eye bolts.

## **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 Books:**

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

#### **Reference Books:**

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

## N - SCHEME

(Implemented from the Academic Year 2019-2020 onwards)

Course Name : **DIPLOMA IN MECHANICAL ENGINEERING**

Subject Code : **N - 552**

Semester : **V**

Subject Title : **THERMAL ENGINEERING**

### TEACHING AND SCHEME OF EXAMINATIONS:

Number of Weeks per Semester: 14

SUBJECT	INSTRUCTIONS		EXAMINATIONS			DURATION
	Hrs / Week	Hrs / Sem	MARKS			
THERMAL ENGINEERING	5	70	INTERNAL ASSESSMENT	BOARD EXAMINATION	TOTAL	3 Hrs
			25	100*	100	

\* Examination will be conducted for 100 Marks and it will be reduced to 75 Marks.

### 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
	<b>TOTAL</b>	<b>75</b>

### 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.

**N 552 - 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 – 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 No<sub>2</sub> 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 – 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 – Bypass 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. Raj put, 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.

## N - SCHEME

(Implemented from the Academic Year 2019-2020 onwards)

Course Name : **DIPLOMA IN MECHANICAL ENGINEERING**

Subject Code : **N - 553**

Semester : **V**

Subject Title : **RENEWABLE ENERGY SOURCES AND ENERGY CONSERVATION**

### TEACHING AND SCHEME OF EXAMINATIONS:

Number of Weeks Per Semester : 14

SUBJECT	INSTRUCTIONS		EXAMINATIONS			DURATION
	Hrs / Week	Hrs / Sem	MARKS			
RENEWABLE ENERGY SOURCES AND ENERGY CONSERVATION	5	70	INTERNAL ASSESSMENT	BOARD EXAMINATION	TOTAL	3 Hrs
			25	100*	100	

\* Examination will be conducted for 100 Marks and it will be reduced to 75 Marks.

### TOPICS AND ALLOCATION OF HOURS:

UNIT NO	TOPICS	HOURS
I	FUNDAMENTALS OF ENERGY AND WIND ENERGY	14
II	SOLAR ENERGY, APPLICATION AND STORAGE	14
III	OCEAN AND GEOTHERMAL ENERGY	14
IV	BIO ENERGY	13
V	ENERGY CONSERVATION TECHNIQUES AND ENERGY AUDIT	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, Geo Thermal energy and Bio energy.
- Understand the energy management and auditing techniques.
- Study the energy conservation process.

**N 553 - 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 radiation measurements-Estimation of average solar radiation.

**Solar energy collectors:**

Classifications-Flat plate collectors -Concentrating collectors-performance parameter-tracking system-compound parabolic concentrator-parabolic trough concentrator's concentrator with point focus-heliostats-comparisons of various collectors-efficiency of collector selection of collector for various applications.

**Solar thermal application :**

Solar water heaters-Solar industrial heating system – Solar refrigeration and Air-Conditioning Systems-Solar cookers-Solar furnaces-Solar greenhouse-Solar distillation-Solar pond electric power plant distributed collector- Solar thermal electric power plant.

**Solar thermal energy storage:**

Sensible storage-latent heat storage-thermo chemical storage

**UNIT III** **(14)**  
**OCEAN AND GEOTHERMAL ENERGY**

**Ocean energy:**

Ocean Energy Resources – Principle of Ocean Thermal Energy Conversion (OTEC) – Methods of Ocean Thermal Electric Power Generation – Energy Utilisation – Basic Principle of Tidal Power – Components and operation of Tidal Power Plant – Energy and power forms of waves – wave energy conversion devices.

### **Geo thermal energy:**

Geo Thermal Resources – Prime Movers for Geo Thermal Energy Conversion – Advantages and Disadvantages – Applications – Material Selection for geothermal power plants – Geo Thermal Exploration – Operational and Environmental Problems – Prospects of Geo thermal energy in India.

### **UNIT IV**

**(13)**

#### **BIO – ENERGY:**

Introduction – photo synthesis – usable forms of bio mass, their composition and fuel properties Biomass resources – Biomass conversion technologies – Urban waste to energy conversion – Biomass gasification – biomass liquification – biomass to ethanol production – Biogas production from waste Biomass – types of biogas plants - applications – Bio diesel production – Biomass energy programme 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 utilities 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.

#### **Reference Books:**

1. Non-Conventional Energy Resources - B.H.Khan - Tata Mc Graw Hill, 2nd Edn, 2009.
2. Industrial energy conservation- D. A. Ray- Pergaman
3. Energy resource management- Kirpal Singh Jogi- Sarup and sons.

## N - SCHEME

(Implemented from the Academic Year 2019-2020 onwards)

Course Name : **DIPLOMA IN MECHANICAL ENGINEERING**

Subject Code : **N - 5541**

Semester : **V**

Subject Title : **ADVANCED MACHINING PROCESS**

### TEACHING AND SCHEME OF EXAMINATIONS:

Number of Weeks per Semester: 14

SUBJECT	INSTRUCTIONS		EXAMINATIONS			DURATION
	Hrs / Week	Hrs / Sem	MARKS			
ADVANCED MACHINING PROCESS	5	70	INTERNAL ASSESSMENT	BOARD EXAMINATION	TOTAL	3 Hrs
			25	100*	100	

\* Examination will be conducted for 100 Marks and it will be reduced to 75 Marks.

### TOPICS AND ALLOCATION OF HOURS:

UNIT NO	TOPICS	HOURS
I	AUTOMATIC LATHES AND GEAR MANUFACTURING PROCESS	14
II	MECHANICAL ENERGY BASED PROCESS	14
III	ELECTRICAL ENERGY BASED PROCESS	14
IV	CHEMICALS AND ELECTRO CHEMICAL ENERGY BASED PROCESSES	13
V	THERMAL ENERGY BASED PROCESSES	13
	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 personal 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 of powder metallurgy.
- Study about the metal cutting tools.

**N 5541 - ADVANCED MACHINING PROCESS  
DETAILED SYLLABUS**

**UNIT I** **(14)**

**AUTOMATIC LATHES:**

Automatic lathe – classification of single spindle automatic lathe – principle of automatic lathes – automatic screw cutting machines – multi spindle automatic lathes transfer machines – In-line & rotary types, advantages & disadvantages.

**GEAR MANUFACTURING PROCESS:**

Gear manufacturing processes: Gear broaching -- Gear shaper-gear hobbing principle of operation only-gear finishing processes-burnishing shaving-grinding and lapping-gear materials-cast iron, steel, alloy steels, brass, bronze, aluminium, nylon.

**UNIT II** **(14)**

**MECHANICAL ENERGY BASED PROCESS:**

Ultrasonic Machining: Principle- transducer types - concentrators abrasive slurry – advantages, limitations and applications. Abrasive Jet Machining: Process- principle – advantages, limitations and applications. Water Jet Machining: Principle -advantages and limitations - practical applications.

**UNIT III** **(14)**

**ELECTRICAL ENERGY BASED PROCESS:**

Electrical Discharge Machining (EDM), Mechanism of metal removal – Dielectric fluid - Electrode materials - Spark erosion generators: Electrode feed system - Tool electrode, Design - Characteristics of spark eroded surfaces - advantages and limitations - practical applications EDM wire cut and grinding: principle – Wire feed system--advantages and limitations - practical applications.

**UNIT IV** **(13)**

**CHEMICALS AND ELECTRO CHEMICAL ENERGY BASED PROCESSES:**

Chemical Machining: Fundamentals, principle -classification and selection of etchant - chemical milling, engraving, blanking, drilling and trepanning- advantages, limitations and applications. Electro Chemical Machining: Electrochemistry of the process-electrolytes-electrolyte and their properties – advantages, limitations and applications - Electro Chemical Grinding: Honing, cutting off, deburring and turning".

**UNIT V** **(13)**

**THERMAL ENERGY BASED PROCESSES:**

Electron Beam Machining: Principle -Generation and control of electron beam-advantages ,limitations and applications--Laser Beam Machining: Principle solid and gas Laser applications. Thermal features of LBM advantages, limitations and applications. Lon Beam Machining: equipment – advantages, limitations and applications. Plasma Arc Machining: Principle -Gas mixture- types,

Of torches –advantages, limitations and applications.

**Text Books:**

1. "Modern Machining Process", P.C Pandey And H"S" Shan, Tata Mc Graw – Hill Publishing Company Limited, New Delhi, 2007
2. " Advanced Machining Process",V.K. Jain, Allied Publishers PW Limited 2007

**Reference Books:**

1. "New Technology", Amitadha Bhattacha ryya, The Institution Of Engineers , (India).
2. "Production Technology", HMT Banglore, Tata Mc Graw-Hill Publishing Company Limited,New Delhi, 2006.
3. "Text Book of Production Enginee ring" , P"C. SharmaS. Chand & Company Ltd., Ramnagar,New Delhi.
4. "Elements of workshop Technology", S.K. Hajra Choudhuryo S.K. Bose, A.K. Hajra Choudhrry,N irjhar roy.

**N - SCHEME**

(Implemented from the Academic Year 2019-2020 onwards)

Course Name : **DIPLOMA IN MECHANICAL ENGINEERING**Subject Code : **N - 5542**Semester : **V**Subject Title : **PRESS TOOLS****TEACHING AND SCHEME OF EXAMINATIONS:**

Number of Weeks per Semester: 14

SUBJECT	INSTRUCTIONS		EXAMINATIONS			
	Hrs / Week	Hrs / Sem	MARKS			DURATION
PRESS TOOLS	5	70	INTERNAL ASSESSMENT	BOARD EXAMINATION	TOTAL	3 Hrs
			25	100*	100	

\* Examination will be conducted for 100 Marks and it will be reduced to 75 Marks.

**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.

**OBJECTIVES:**

- 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.

**N 5542 - PRESS TOOLS  
DETAILED SYLLABUS**

**UNIT I**

**(14)**

**PRESS WORKING FUNDAMENTALS, OPERATIONS, AND MACHINERY:**

Shearing Theory-Critical stages of shearing, Features of punched whole, 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 of mechanical, hydraulic and pneumatic presses. Single action, double action and triple action presses Press 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, mechanical ejection, 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 working principle) – 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, inverted

draw 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 – Mar form 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 SPECIALIZED 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. ASTM E, “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)

## N - SCHEME

(Implemented from the Academic Year 2019-2020 onwards)

Course Name : **DIPLOMA IN MECHANICAL ENGINEERING**

Subject Code : **N - 5543**

Semester : **V**

Subject Title : **TOTAL QUALITY MANAGEMENT**

### TEACHING AND SCHEME OF EXAMINATIONS:

Number of Weeks per Semester: 14

SUBJECT	INSTRUCTIONS		EXAMINATIONS			DURATION
	Hrs / Week	Hrs / Sem	MARKS			
TOTAL QUALITY MANAGEMENT	5	70	INTERNAL ASSESSMENT	BOARD EXAMINATION	TOTAL	3 Hrs
			25	100*	100	

\* Examination will be conducted for 100 Marks and it will be reduced to 75 Marks.

### 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.

**N 5543 – TOTAL QUALITY MANAGEMENT  
DETAILED SYLLABUS**

**UNIT I** **(14)**

**BASIC CONCEPTS OF TOTAL QUALITY MANAGEMENT:**

Quality-Definitions- Dimensions of quality-Brainstorming and its objectives  
Introduction to TQM – Characteristics – Basic concepts – Elements – Pillars – Principles  
- Obstacles to TQM implementation – Potential benefits of TQM – Quality council –  
Duties – Responsibilities – Quality statements – Vision – Mission – Quality policy  
statements – Strategic planning – Seven steps to strategic planning – Deming philosophy  
Customer delight-ISO 9001:2008 Quality Management System requirements and  
implementation.

**UNIT II** **(14)**

**CONTINUOUS PROCESS IMPROVEMENT – Q-7 TOOLS:**

Input / Output process model – Juran Trilogy – PDCA (Deming Wheel) cycle – 5S  
Concepts – SEIRI, SEITON, SEISO, SEIKETSU and SHITSUKE – Needs and objectives –  
Effective implementation of 5S concepts in an organisation - Housekeeping – Kaizen –  
Comparison between Kaizen and Kairyo. Seven tools of quality control (Q-7 tools) –  
Check sheet – Types of check sheet – Histogram – Cause and effect diagram - Pareto  
diagram –Stratification Analysis – Scatter diagram-Graph/run charts – 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 central tendency –  
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 specification limits – Process capability – Method of  
doing process capability Analysis – Measures of process capability – Problems.  
Attributes – Control charts – P chart – np chart – c chart – u chart – Construction of  
above diagrams – Problems - Comparison between variable chart and Attribute chart.

**UNIT V** **(13)**

**MANAGEMENT PLANNING TOOLS & BENCH MARKING:**

Affinity diagram –Radar diagram -Inter relationship diagram (Inter Relationship 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 Books:**

1. “Total Quality Management”, Date H.Besterfiled, Pearson Education Asia. (Indian reprint 2002)
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 Books:**

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.

## N - SCHEME

(Implements from the Academic Year 2019-2020 onwards)

Course Name : **DIPLOMA IN MECHANICAL ENGINEERING**

Subject Code : **N - 555**

Semester : **V**

Subject Title : **THERMAL ENGINEERING PRACTICAL**

### TEACHING AND SCHEME OF EXAMINATIONS:

Number of Weeks per Semester: 14

SUBJECT	INSTRUCTIONS		EXAMINATIONS			DURATION
	Hrs / Week	Hrs / Sem	MARKS			
THERMAL ENGINEERING PRACTICAL	4	56	INTERNAL ASSESSMENT	BOARD EXAMINATION	TOTAL	3 Hrs
			25	100*	100	

\* Examination will be conducted for 100 Marks and it will be reduced to 75 Marks.

### 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.

### Study Exercise:

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.

## N - SCHEME

(Implements from the Academic Year 2019-2020 onwards)

Course Name : **DIPLOMA IN MECHANICAL ENGINEERING**

Subject Code : **N - 556**

Semester : **V**

Subject Title : **INDUSTRIAL AUTOMATION PRACTICAL**

### TEACHING AND SCHEME OF EXAMINATIONS:

Number of Weeks per Semester: 14

SUBJECT	INSTRUCTIONS		EXAMINATIONS			DURATION
	Hrs / Week	Hrs / Sem	MARKS			
INDUSTRIAL AUTOMATION PRACTICAL	4	56	INTERNAL ASSESSMENT	BOARD EXAMINATION	TOTAL	3 Hrs
			25	100*	100	

\* Examination will be conducted for 100 Marks and it will be reduced to 75 Marks.

### OBJECTIVES:

- 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. Study of Pneumatic Systems.
2. Direct operation of single and double acting cylinder.
3. Operation of double acting cylinder with quick exhaust valve.
4. Speed control of double acting cylinder using metering-in and metering-out circuits.

#### Hydraulics Lab

1. Study of Hydraulic Systems.
2. Direct operation of double acting cylinder.
3. Direct operation of hydraulic motor.
4. Speed control of double acting cylinder metering-in and metering-out control.

## **PLC Lab**

1. Study of PLC Systems
2. Direct operation of a motor using latching circuit.
3. Operation of a motor using 'AND' logic control.
4. Operation of a motor using 'OR' control.
5. On-Delay control of a motor and Off-Delay control of a motor.
6. Automatic operation of a Double acting cylinder-single cycle.
7. Automatic operation of a Double acting cylinder-single cycle - forward, time delay, return.
8. Automatic operation of Double acting cylinder-Multi cycle.
9. Sequential operation of double acting cylinder and a motor.

## N - SCHEME

Course Name : **All branches of Diploma in Engineering**

Subject code : **N557**

Semester : **V Semester**

Subject Title: **LIFE AND EMPLOYABILITY SKILL PRACTICAL PRACTICAL**

### **TEACHING AND SCHEME OF EXAMINATION**

Number of weeks per semester: 14 weeks

Subject	Instructions		Examination			Duration
	Hours/ Week	Hours/ Semester	Marks			
LIFE AND EMPLOYABILITY SKILL PRACTICAL#			Internal Assessment	Board Examination	Total	
	4 Hrs.	56 Hrs.	25	100*	100	3 Hrs

#Common to all branches

\*Examination will be conducted for 100 Marks and it will be reduced to 75 Marks.

### **Topics and Allocation of Hours:**

UNIT	TOPIC	TIME
1	Listening Skill	12
2	Reading Skill	11
3	Speaking Skill	11
4	Writing Skill	11
5	Computer Aided Communication	11
	<b>Total</b>	<b>56 Hrs</b>

### **RATIONALE:**

- “The quality of your life is in the quality of your communication” opined Antony Robins. Language is the means of self expression and one of the prime most tools for communication. Communicative fluency augments one’s personal, academic, social and professional life.
- The present syllabus, focusing on four communication skills viz Listening, Reading, Speaking and writing, enables the students at Diploma level gain confidence and fluency in communication which in turn would enhance them face their career commitments with globalized standards.

## **OBJECTIVES:**

At the completion of the study, the students will be able to

- Improve their auditory skills to attentively listen, effectively comprehend and to identify important information and key words.
- Fine tune reading skills.
- Perfect their reading comprehending skills using the techniques like skimming to get the general idea and scanning to grasp specific information.
- Widen up their horizon of knowledge by reading news items and spice their language with acronyms and abbreviations when and where necessary.
- Pronounce words with renewed confidence.
- Expressing their needs, obligations, suggestions, gratitude and apology with poise and conviction.
- Introduce themselves and others in a self assuring manner.
- Partake in face to face conversation with skilled agility.
- Describing places, machines, events and experiences adeptly.
- Emphatically writing and completing the missing parts.
- Acquire a sound knowledge on the usage of non verbal communication.

## DETAILED SYLLABUS

Contents: **Practical**

<b>Unit</b>	<b>Name of Topics</b>	<b>Hours</b>
<b>1</b>	1. Listening to speeches by Great Speakers (Assessment through Note Taking) 2. Listening to Indian English (Assessment through presenting core Ideas) 3. Listening to Short Stories (Assessment through vocabulary check)	<b>12</b>
<b>2</b>	1. Tongue Twisters / Modulators / Conditioners 2. Skimming and Scanning 3. Reading Newspaper 4. Frequently Mispronounced Words.	<b>11</b>
<b>3</b>	1. Expressions (Greeting, Requesting, Thanking, Apologizing, Opinions and Suggestions) 2. Introducing oneself / others 3. Face to face Conversation 4. Description of object	<b>11</b>
<b>4</b>	1. Thought Fillers 2. Newspaper Comprehension 3. Non-Verbal Communication	<b>11</b>
<b>5</b>	1. Listening and Responding to Talks 2. Preparing Word Cloud 3. Interpreting a Picture	<b>11</b>

## LIFE AND EMPLOYABILITY SKILL PRACTICAL QUESTION PATTERN

**Time: 3 Hours**

**Name:**

**Register Number:**

**Max. Marks: 100**

**Date:**

**Dept:**

### **A. LISTENING (20 Marks)**

1. Listen to the legendary speech and take down notes/hints marks 05
2. Listen to the passage and answer the following questions. 10 marks
3. Listen to the story and fill in the blanks with the exact words heard. 05 marks

### **B. READING (20 Marks)**

1. Read out the following tongue twister loudly with correct pronunciation. 05 marks
2. Read out the following passage and retrieve the information from the text by skimming and scanning. 05 marks
3. Read out the content from the newspaper with correct accent, intonation and pronunciation. 05 marks
4. Read out the given words with correct pronunciation (Frequently mispronounced words). 05 marks

### **C. SPEAKING (20 Marks)**

1. Say any five expressions commonly used in communication. 05 marks
2. Introduce yourself before the interview committee. 05 marks
3. Speak with the clerk in the bank regarding the opening of a savings account. 05 marks
4. Describe the features of a new mobile you bought recently. 05 marks

### **D. WRITING (20 Marks)**

1. Fill in the blanks with correct thought fillers in the following sentences. 05 marks
2. Read the news paper report carefully and answer the following questions. 10 marks
3. Explain the different types of non verbal communication. 05 marks

### **E. COMPUTER AIDED COMMUNICATION (20 Marks)**

1. Watch out the short speech video on the computer and give out your comments. 05 marks
2. Frame five sentences of your own and create a word cloud out of them. 10 marks
3. Study the following visual and interpret it in your own words 05 marks

\*\*\*\*\*

**N - SCHEME**

(Implemented from the Academic Year 2019-2020 onwards)

Course Name : **DIPLOMA IN MECHANICAL ENGINEERING**Subject Code : **N - 561**Semester : **VI**Subject Title : **INDUSTRIAL ENGINEERING AND MANAGEMENT****TEACHING AND SCHEME OF EXAMINATIONS:**

Number of Weeks per Semester: 14

SUBJECT	INSTRUCTIONS		EXAMINATIONS			DURATION
	Hrs / Week	Hrs / Sem	MARKS			
INDUSTRIAL ENGINEERING AND MANAGEMENT	6	84	INTERNAL ASSESSMENT	BOARD EXAMINATION	TOTAL	3 Hrs
			25	100*	100	

\* Examination will be conducted for 100 Marks and it will be reduced to 75 Marks

**TOPICS AND ALLOCATION OF HOURS:**

UNIT NO	TOPICS	HOURS
I	PLANT LAYOUT AND PLANT SAFETY	17
II	WORK STUDY, METHOD STUDY AND WORK MEASUREMENT	17
III	PRODUCTION PLANNING AND QUALITY CONTROL	17
IV	PRINCIPLES OF MANAGEMENT AND PERSONAL MANAGEMENT	16
V	FINANCIAL MANAGEMENT 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 its behaviour.

**N 561 - INDUSTRIAL ENGINEERING AND MANAGEMENT  
DETAILED SYLLABUS**

**UNIT I**

**(17)**

**PLANT LAYOUT AND PLANT SAFETY**

**Plant Layout :** Plant – Selection of site of industry – Plant layout – Principles of a good layout – types – process, product and fixed position – techniques to improve layout – Principles of material handling equipment – Plant maintenance – importance – Break down maintenance, preventive maintenance and scheduled maintenance.

**Plant Safety:** Importance –accident-causes and cost of an accident-accident proneness-prevention of accidents-Industrial disputes-settlement of Industrial disputes-Collective bargaining, conciliation, Mediation, arbitration-Indian Factories Act 1948 and its provisions related to health, welfare and safety.

**UNIT II**

**(17)**

**WORK STUDY, METHOD STUDY AND WORK MEASUREMENT**

**Work Study:** Productivity – Standard of living – method of improving productivity – Objectives – Importance of good working conditions.

**Method Study:** Definition – Objectives – Selection of a job for method study –Basic procedure for conduct of method study – Tools used – Operation process chart, Flow process chart, two handed process chart, Man machine chart, String diagram and flow diagram.

**Work Measurement:** Definition – Basic procedure in making a time study – Employees rating factor – Application of time allowances – Rest, Personal, and Process, Special and Policy allowances – Calculation of standard time – Problems – Basic concept of production study – Techniques of work measurement-Ratio delay study, Synthesis from standard data, analytical estimating and Pre determined Motion Time System (PMTS).

**UNIT III**

**(17)**

**PRODUCTION PLANNING AND QUALITY CONTROL**

**Production Planning and Control:** Introduction – Major functions of production planning and control – Pre planning – Methods of forecasting – Routing and scheduling – Dispatching and controlling Concept of Critical Path Method (CPM)-Description only. Production – types-Mass production, batch production and job order production-Characteristics – Economic Batch Quantity (EBQ) – Principles of product and process planning – make or buy decision.

**Quality Control:** Definition – Objectives – Types of inspection – First piece, Floor and centralized inspection – Advantages and disadvantages. Quality control – Statistical quality control – Types of measurements – Method of variables – Method of attributes – Uses of X, R, p and c charts – Operating Characteristics curve (O.C curve) – Sampling inspection – single and double sampling plan – Concept of ISO 9001:2015 Quality Management System Registration Certification procedure – Benefits of ISO to the organization.

## UNIT IV

(16)

### PRINCIPLES OF MANAGEMENT AND PERSONAL MANAGEMENT

**Principles of Management:** Definition of management – Administration - Organization – F.W. Taylor’s and Henry Fayol’s Principles of Management – Functions of Manager – Directing – Leadership - Styles of Leadership – Qualities of a good leader – Motivation – Positive and negative motivation - -Modern management techniques- Just In Time – Total Quality Management (TQM) – Quality circle – Zero defect concept – 5S Concept- Management Information Systems – Strategic management – SWOT Analysis --Business Process Re-engineering (BPR) – Enterprises Resource Planning (ERP) –Supply Chain Management (SCM) – Activity Based Management (ABM) – Global Perspective – Principles and brief description.

**Personnel Management:** Responsibility of human resource management – Selection procedure – Training of workers – Apprentice training – On the job training and vestibule school training – Job evaluation and merit rating – objectives and importance – wages and salary administration – Components of wages – Wage fixation – Type of wage payment – Halsey’s 50% plan, Rowan’s plan and Emerson’s efficiency plan – Problems.

## UNIT V

(16)

### FINANCIAL AND MATERIAL MANAGEMENT

**Financial Management:** Fixed and working capital – Resources of capital – shares preference and equity shares – debentures – Type of debentures – Public deposits, Factory costing – direct cost – indirect cost – Factory overhead – Selling price of a product – Profit – Problems. Depreciation – Causes – Methods - Straight line, sinking fund and percentage on diminishing value method – Problems.

**Material management:** Objectives of good stock control system – ABC analysis of inventory – Procurement and consumption cycle – Minimum Stock, Lead Time, Reorder Level-Economic order quantity problems – supply chain management – Introduction – Purchasing procedure – Store keeping – Bin card.

#### Text Books:

1. Industrial Engineering and Management, O.P. Khanna, Revised Edition Publications (P) Ltd – 2004, 67/4 Madras House, Daryaganj, New Delhi – 110002.
2. Engineering Economics and Management, T.R. Banga & S.C. Sharma, McGraw Hill Edition. 2 – 2001, New Delhi.
3. Herald Koontz and Heinz Weihrich, 'Essentials of Management', McGraw Hill Publishing Company, Singapore International Edition. Latest

**Reference Books:**

1. Management, A global perspective, Heinz Wehrich, Harold Koontz, 10th Edition, McGraw Hill International Edition.Latest.
2. Essentials of Management, 4th Edition, Joseph L.Massie, Prentice-Hall of India, New Delhi 2004.
3. S.Chandran,Organizational Behaviours,Vikas Publishing House Pvt. Ltd. Latest
4. M.Govindarajan and S.Natarajan,Principles of Management,Prentce Hall of India Pvt.Ltd.New Delhi.Latest.

## N - SCHEME

(Implemented from the Academic Year 2019-2020 onwards)

Course Name : **DIPLOMA IN MECHANICAL ENGINEERING**

Subject Code : **N - 562**

Semester : **VI**

Subject Title : **COMPUTER INTEGRATED MANUFACTURING**

### TEACHING AND SCHEME OF EXAMINATIONS:

Number of Weeks per Semester: 14

SUBJECT	INSTRUCTIONS		EXAMINATIONS			DURATION
	HOURS / WEEK	HOURS / SEMESTER	MARKS			
COMPUTER INTEGRATED MANUFACTURING	5	70	INTERNAL ASSESSMENT	BOARD EXAMINATION	TOTAL	3 Hrs
			25	100*	100	

\* Examination will be conducted for 100 Marks and it will be reduced to 75 Marks

### TOPICS AND ALLOCATION OF HOURS:

UNIT NO	TOPICS	HOURS
I	INTRODUCTION OF CIM AND COMPUTER AIDED DESIGN	14
II	COMPUTER AIDED MANUFACTURING	14
III	CNC PROGRAMMING AND RAPID PROTOTYPING	14
IV	FLEXIBLE MANUFACTURING SYSTEMS,AUTOMATIC GUIDED VEHICLE, ROBOT	13
V	CONCURRENT ENGINEERING, QUALITY FUNCTION DEPLOYMENT, PRODUCT DEVELOPMENT CYCLE, 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.

## N 562 - COMPUTER INTEGRATED MANUFACTURING DETAILED SYLLABUS

### UNIT I

(14)

#### INTRODUCTION OF CIM AND COMPUTER AIDED DESIGN

**Introduction of CIM:** Concept of CIM – Evaluation of CIM – CIM Wheel – Benefits of CIM – Integrated of CAD and CAM.

**Computer Aided Design:** Introduction – definition – Shigley’s design process – Ohsga Model – CAD activities – benefits of CAD –CAD software packages. 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 – Boolean operations – 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 CODE System.

**Process Planning:** Introduction – Computer Assisted Process Planning (CAPP) – Types of CAPP - Variant type, Generative type –advantages of CAPP.

**Production Planning and Control (PPC):** Definition – objectives -Computer Integrated Production management system – Master Production Schedule (MPS) – Capacity Planning – Materials Requirement Planning (MRP) – Manufacturing Resources Planning(MRP-II) – Shop Floor

Control system (SFC) - Just In Time manufacturing philosophy (JIT) - Introduction to Enterprise Resources Planning (ERP).

### UNIT III

(14)

#### CNC PROGRAMMING AND 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)

#### **FLEXIBLE MANUFACTURING SYSTEMS, AUTOMATIC GUIDED VEHICLE, ROBOT**

**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)

#### **CONCURRENT ENGINEERING, QUALITY FUNCTION DEPLOYMENT, PRODUCT DEVELOPMENT CYCLE, 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 ,Mikell P.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.

### N - SCHEME

(Implemented from the Academic Year 2019-2020 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Subject Code : N - 5631

Semester : VI

Subject Title : **AUTOMOBILE ENGINEERING**

#### TEACHING AND SCHEME OF EXAMINATIONS:

Number of Weeks per Semester: 14 Weeks

SUBJECT	INSTRUCTIONS		EXAMINATIONS			DURATION
	HOURS / WEEK	HOURS / SEMESTER	MARKS			
AUTOMOBILE ENGINEERING	5	70	INTERNAL ASSESSMENT	BOARD EXAMINATION	TOTAL	3 Hrs
			25	100*	100	

\* Examination will be conducted for 100 Marks and it will be reduced to 75 Marks

#### TOPICS AND ALLOCATION OF HOURS:

UNIT NO	TOPICS	HOURS
I	ENGINES AND ITS COMPONENTS	14
II	FUEL FEED SYSTEM AND TYPES OF FUEL	14
III	POWER DRIVE	14
IV	SKELETON OF AUTOMOBILE	13
V	ELECTRICAL SYSTEM IN AUTOMOBILE AND 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.

**N 5631 - AUTOMOBILE ENGINEERING  
DETAILED SYLLABUS**

**UNIT I**

**(14)**

**ENGINES AND ITS COMPONENTS**

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.

Valve and valve mechanism – Stages of combustion – Delay period – Variables affecting delay period – Combustion chambers – Types of combustion chambers – merits and demerits – thermo syphon system – pump assisted water cooling systems – components – water pump, fan – thermostat – types – Radiator – types – pressure cap – temperature sensors – troubles in cooling system – loss of coolant, overheating and over cooling – causes. oil pumps – oil filters – full flow and bypass filter systems – Oil leakage, low oil pressure and excessive oil consumption – Causes.

**UNIT II**

**(14)**

**FUEL FEED SYSTEM AND TYPES OF FUEL**

Requirements 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 – fuel filter – Air cleaners – types.

Carburation – Classification of carburetors – 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 – Nozzle Types – Governors – Mechanical and Pneumatic Governors.

**UNIT III**

**(14)**

**POWER DRIVE**

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. Differential – 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)**

#### **SKELETON OF AUTOMOBILE**

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)**

#### **ELECTRICAL SYSTEM IN AUTOMOBILE AND POLLUTION CONTROL**

Battery – Lead acid battery – Nickel alkaline battery – Construction – battery rating – Charging – Testing – Starting circuit – Types 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 – 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 ) – Treatment of exhaust gas ( Catalytic converter, EGR ) – Introduction to automobile electronics – Radio interference – Suppressors – Audio, Video systems.

**Text Books:**

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

**Reference Books:**

- Vehicle and Engine Technology, Vol-I, Heinz Heisler, ELBS.
- Automotive Mechanics, Joseph Heitner, East-West Press (P) Ltd, New Delhi.
- Internal Combustion Engines, M.L. Mathur & R.P. Sharma, Dhanpat Rai & Sons, New Delhi.

### N - SCHEME

(Implemented from the Academic Year 2019-2020 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Subject Code : N - 5632

Semester : V

Subject Title : **ROBOTICS AND AUTOMATION**

#### TEACHING AND SCHEME OF EXAMINATIONS:

Number of Weeks per Semester: 14

SUBJECT	INSTRUCTIONS		EXAMINATIONS			DURATION
	HOURS / WEEK	HOURS / SEMESTER	MARKS			
ROBOTICS AND AUTOMATION	5	70	INTERNAL ASSESSMENT	BOARD EXAMINATION	TOTAL	3 Hrs
			25	100*	100	

\* Examination will be conducted for 100 Marks and it will be reduced to 75 Marks

#### TOPICS AND ALLOCATION OF HOURS:

UNIT NO	TOPICS	HOURS
I	FUNDAMENTALS OF ROBOT TECHNOLOGY	14
II	ROBOT CONTROLLER, DRIVE SYSTEMS AND END EFFECTORS	14
III	SENSORS AND MACHINE VISION	14
IV	ROBOT KINEMATICS AND ROBOT PROGRAMMING	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 technology 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.

**N5632 - ROBOTICS AND AUTOMATION  
DETAILED SYLLABUS**

**UNIT I** **(14)**

**FUNDAMENTALS OF ROBOT TECHNOLOGY**

Introduction – History of robot - Definitions-Robot Anatomy – Basic configuration of Robotics – Robot Components – Manipulator, End effector, 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. End effecters – Grippers – Mechanical Grippers, Magnetic Grippers, Vacuum Grippers, Two fingered and Three fingered Grippers, Internal and External Grippers – End Of Arm 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, Optical encoders and Pneumatic position sensors – Range sensors – Proximity sensors: Inductive, Capacitive, Ultrasonic and Optical proximity sensors – Touch sensors: Binary sensors, Analog sensors – Wrist sensors – Slip sensors. Machine vision system –Camera – Frame grabber – Sensing and digitizing image data –Signal conversion – Image storage – Lighting techniques – Image processing and analysis – Data reduction: Edge detection, Feature extraction and object recognition – Applications – Inspection, Identification, Visual serving and navigation

**UNIT IV** **(13)**

**ROBOT KINEMATICS AND ROBOT PROGRAMMING**

Forward kinematics, Inverse kinematics and differences – Forward kinematics and Reverse kinematics of manipulators with Two and Three degrees of freedom – Deviations. – Robot dynamics – Static Load through programming – Robot programming

languages – VAL Programming – Motion commands, Sensor commands, End effector commands and Simple programs.

## **UNIT V**

**(13)**

### **ROBOT APPLICATIONS IN MANUFACTURING**

Robot applications – Material handling – Press loading and unloading – 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-
2. Hill Book Co., 1987
3. Robotics for Engineers, Yoram Koren, McGraw-Hill Book Co., 1992
4. Robotics and Image Processing, Janaki raman.P.A, Tata McGraw-Hill,1995

### N - SCHEME

(Implements from the Academic Year 2019-2020 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Subject Code : N - 5633

Semester : V

Subject Title : **REFRIGERATION AND AIR CONDITIONING**

#### TEACHING AND SCHEME OF EXAMINATIONS:

Number of Weeks per Semester: 14

SUBJECT	INSTRUCTIONS		EXAMINATIONS			DURATION
	HOURS / WEEK	HOURS / SEMESTER	MARKS			
REFRIGERATION AND AIR CONDITIONING	5	70	INTERNAL ASSESSMENT	BOARD EXAMINATION	TOTAL	3 Hrs
			25	100*	100	

\* Examination will be conducted for 100 Marks and it will be reduced to 75 Marks

#### TOPICS AND ALLOCATION OF HOURS:

UNIT NO	TOPICS	HOURS
I	REFRIGERATION SYSTEM AND REFRIGERATION EQUIPMENTS	14
II	VAPOUR COMPRESSION & ABSORPTION REFRIGERATION SYSTEM AND CRYOGENIC REFRIGERATION SYSTEMS	14
III	REFRIGERATION FLOW CONTROLS, REFRIGERANTS AND LUBRICANTS AND APPLICATIONS OF REFRIGERATION	14
IV	PSYCHOMETRICS AND COMFORT AIR CONDITIONING SYSTEMS	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.

**N 5663 - 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-problems Compressor – principle of working and constructional details of reciprocating and rotary compressors, hermetically and semi hermetically sealed compressors- condensers-principle of working and constructional details of air cooled and water cooled condensers, evaporative condensers- advantages and disadvantages - natural and forced draught cooling towers. Evaporators- natural circulation and forced circulation type – principle of working constructional details.

**UNIT II** **(14)**  
**VAPOUR COMPRESSION REFRIGERATION SYSTEM, VAPOUR ABSORPTION REFRIGERATION SYSTEM AND CRYOGENIC REFRIGERATION 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 2K - Philips Refrigerator—Giffereed McMohan refrigerator- refrigerators for below 2 K - Magnetic refrigeration systems.

**UNIT III** **(14)**  
**REFRIGERATION FLOWCONTROLS, REFRIGERANTS AND LUBRICANTS 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 SO<sub>2</sub> , CH<sub>4</sub> ,F22, and NH<sub>3</sub> – 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)**  
**PSYCHOMETRICS AND COMFORT AIR CONDITIONING SYSTEMS**

Psychrometry properties - adiabatic saturation of air by evaporation of water- psychrometric chart and its uses - psychrometric 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, ENERGY CONSERVATION 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.

## N - SCHEME

(Implements from the Academic Year 2019-2020 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Subject Code : N - 564

Semester : VI

Subject Title : **COMPUTER INTEGRATED MANUFACTURING PRACTICAL**

### TEACHING AND SCHEME OF EXAMINATIONS:

Number of Weeks per Semester: 14

SUBJECT	INSTRUCTIONS		EXAMINATIONS			DURATION
	HOURS / WEEK	HOURS / SEM	MARKS			
COMPUTER INTEGRATED MANUFACTURING PRACTICAL	4	56	INTERNAL ASSESSMENT	BOARD EXAMINATION	TOTAL	3 Hrs
			25	100*	100	

\* Examination will be conducted for 100 Marks and it will be reduced to 75 Marks

### OBJECTIVES:

- 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.

### Introductions

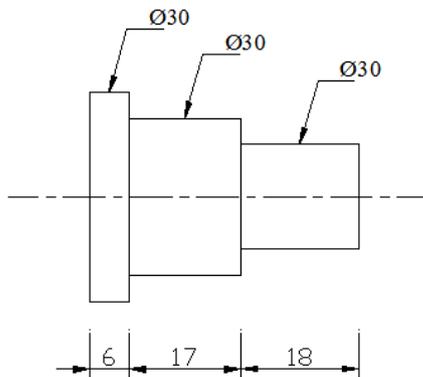
- Study of CNC lathe, milling
- Study of international standard G-Codes and M-Codes
- Program writing – Turning simulator – Milling simulator, IS practice – commands – menus
- Editing the program in the CNC machines
- Execute the program in the CNC machines.

## LIST OF EXPERIMENTS

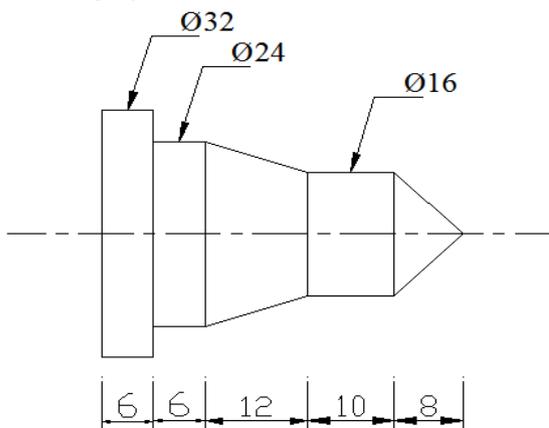
### PART – A (Simulation)

#### CNC Turning Simulation

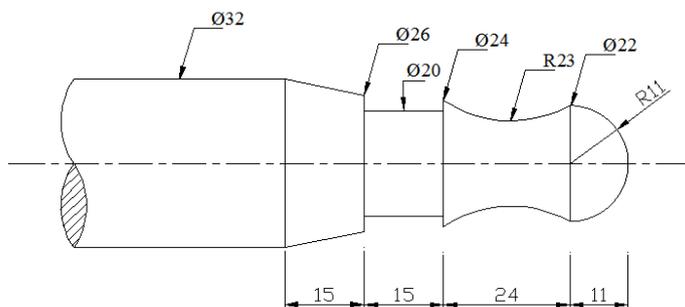
1. Create a Part Program for Step Turning and Simulate in the Software – Using Linear Interpolation



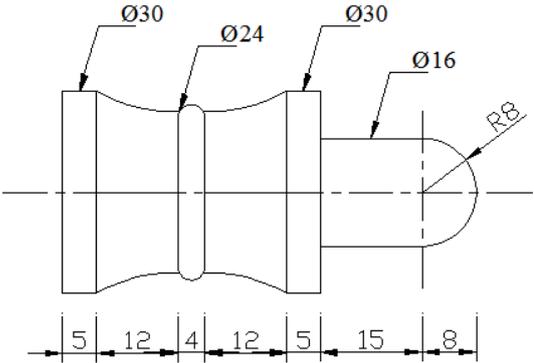
2. Create a Part Program for Taper Turning and Simulate in the Software – Using Box Turning Cycle



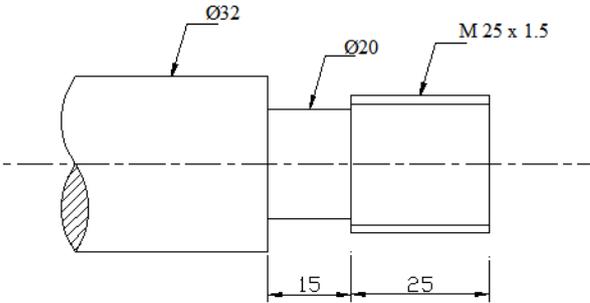
3. Create a Part Program for Circular Interpolation and Simulate in the Software – Using Circular Interpolation



4. Create a Part Program for Multiple Turning Operations and Simulate in the Software – Using Stock Removal Cycle

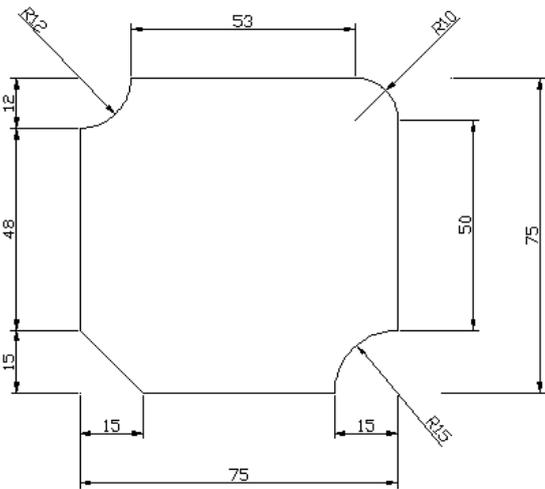


5. Create a Part Program for Thread Cutting, Grooving and Simulate in the Software – Using Canned Cycle

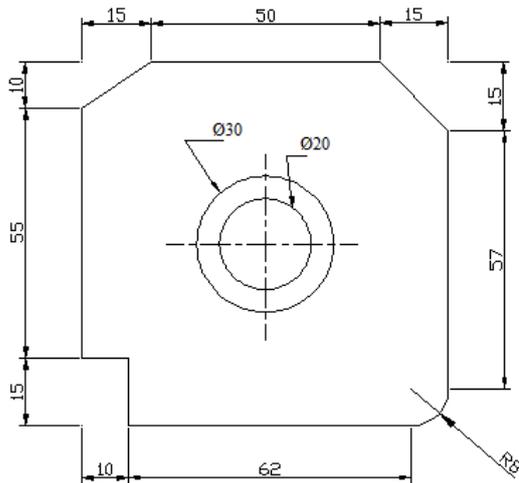


**CNC Milling Simulation**

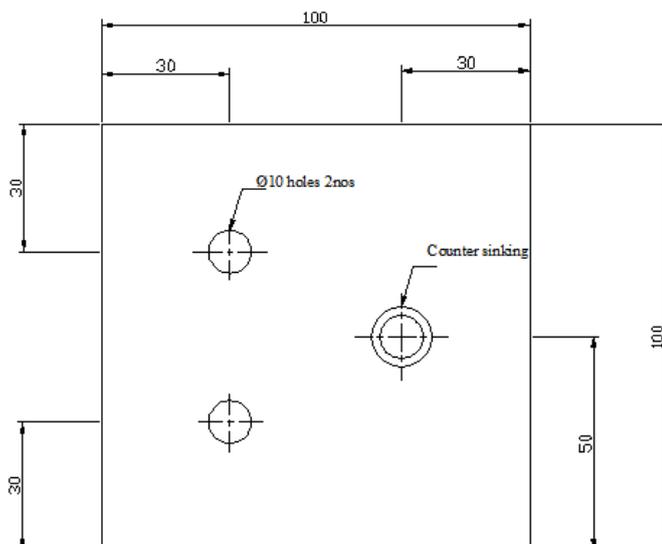
1. Create a Part Program for Grooving and Simulate in the Software – Using Linear Interpolation and Circular Interpolation



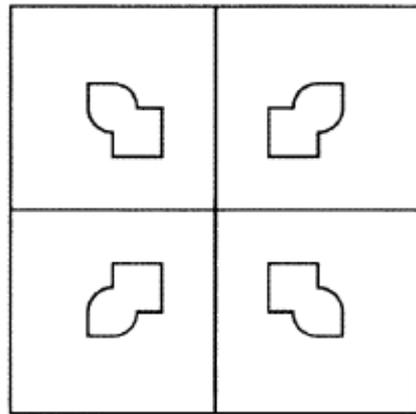
2. Create a Part Program for Grooving and Simulate in the Software – Using Linear Interpolation and Circular Interpolation



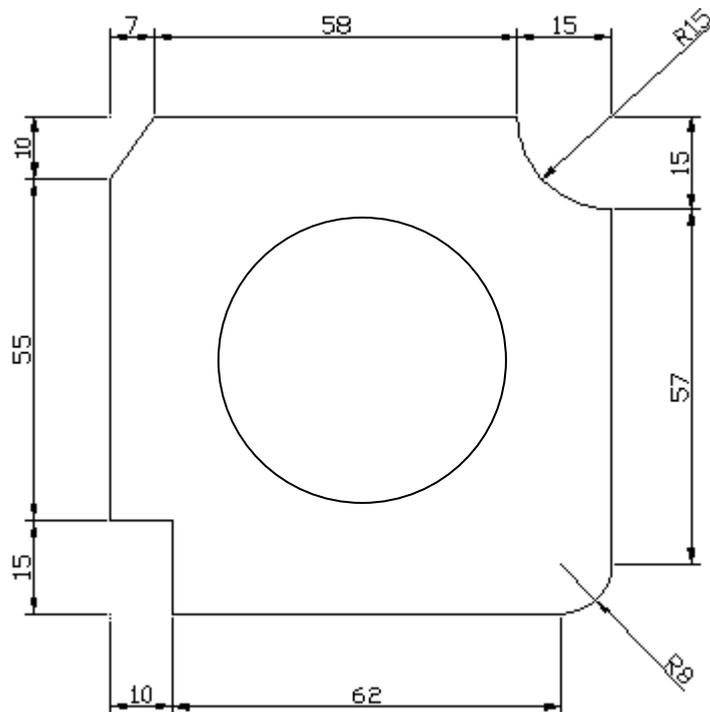
3. Create a Part Program for Drilling and Counter Sinking and Simulate in the Software – Using Canned Cycle



4. Create a Part Program for Mirroring and Simulate in the Software – Using Sub Program



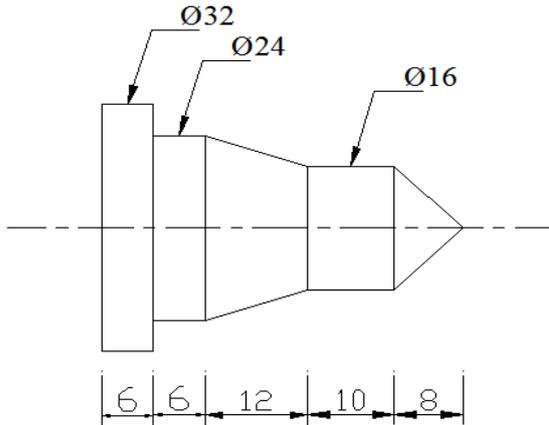
5. Create a Part Program for Rectangular and Circular Pocketing and Simulate in the Software – Using Canned Cycle



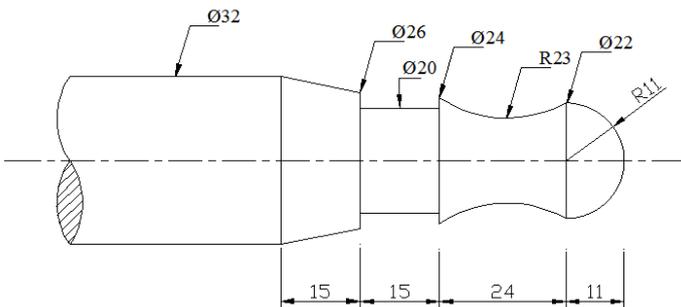
**PART - B (Machining)**

**CNC Turning Machining Material: Aluminium or acrylic fibre rod or plastic**

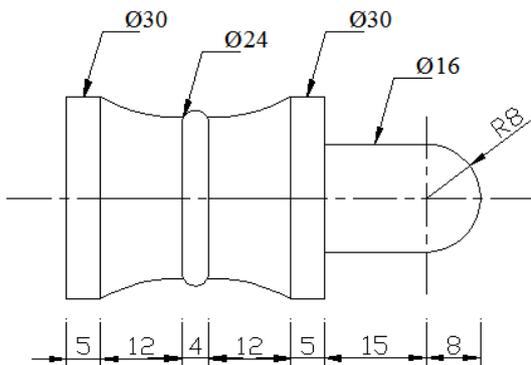
- Using Box Turning Cycle – Create a Part program for Step and Taper Turning and Produce component in the machine



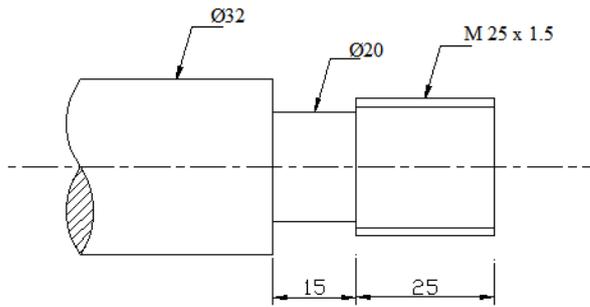
- Using Circular Interpolation – Create a Part program for Circular Interpolation and Produce component in the machine



- Using Stock Removal Cycle – Create a Part program for Multiple Turning Operations and Produce component in the machine

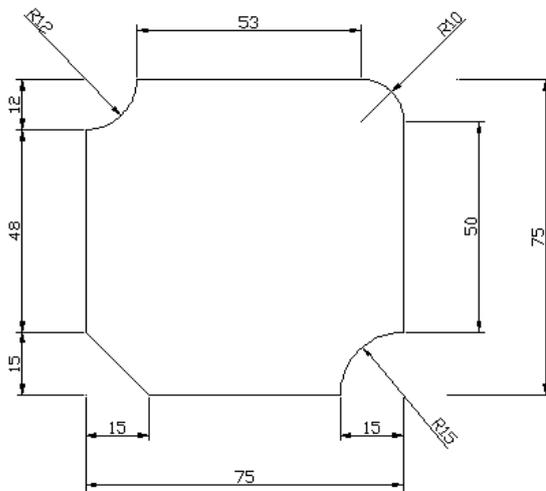


- Using Canned Cycle – Create a Part program for Thread Cutting and Grooving and Produce component in the machine

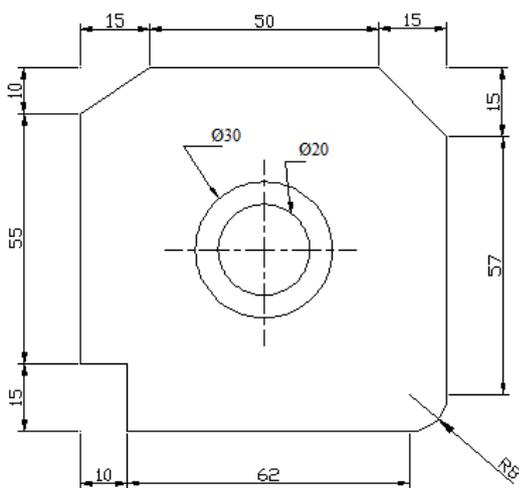


**CNC Milling Machining Material: Aluminium or acrylic fibre rod or plastic**

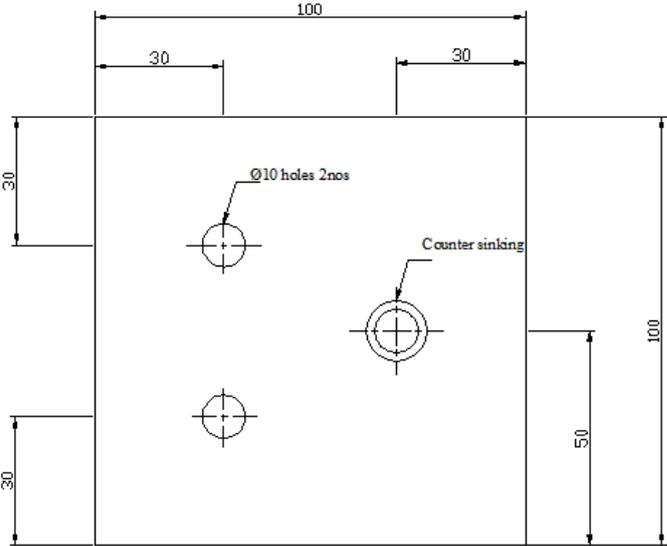
1. Using Linear Interpolation and Circular Interpolation – Create a Part program for Grooving and Produce component in the machine



2. Using Linear Interpolation and Circular Interpolation – Create a Part program for Grooving and Produce component in the machine



3. Using Canned Cycle – Create a Part program for Drilling and Counter Sinking and Produce component in the machine



## N - SCHEME

(Implemented from the Academic Year 2019-2020 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Subject Code : N - 565

Semester : IV

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

### TEACHING AND SCHEME OF EXAMINATIONS:

Number of Weeks per Semester: 14

SUBJECT	INSTRUCTIONS		EXAMINATIONS			DURATION
	HOURS / WEEK	HOURS / SEMESTER	MARKS			
MACHINE TOOL TESTING AND MAINTENANCE PRACTICAL	4	56	INTERNAL ASSESSMENT	BOARD EXAMINATION	TOTAL	3 Hrs
			25	100*	100	

\* Examination will be conducted for 100 Marks and it will be reduced to 75 Marks

### 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 slide ways.
  - 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

## N - SCHEME

(Implements from the Academic Year 2019-2020 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Subject Code : N - 5661

Semester : VI

Subject Title : **AUTOMOBILE ENGINEERING PRACTICAL**

### TEACHING AND SCHEME OF EXAMINATIONS:

Number of Weeks per Semester: 14

SUBJECT	INSTRUCTIONS		EXAMINATIONS			DURATI ON
	HOURS / WEEK	HOURS / SEMESTER	MARKS			
AUTOMOBILE ENGINEERING PRACTICAL	4	56	INTERNAL ASSESSMENT	BOARD EXAMINATION	TOTA L	3 Hrs
			25	100*	100	

\* Examination will be conducted for 100 Marks and it will be reduced to 75 Marks

### 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.

## N - SCHEME

(Implements from the Academic Year 2019-2020 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Subject Code : N - 5662

Semester : VI

Subject Title : **ROBOTICS AND AUTOMATION PRACTICAL**

### TEACHING AND SCHEME OF EXAMINATIONS:

Number of Weeks per Semester: 14

SUBJECT	INSTRUCTIONS		EXAMINATIONS			DURATION
	HOURS / WEEK	HOURS / SEMESTER	MARKS			
ROBOTICS AND AUTOMATION PRACTICAL	4	56	INTERNAL ASSESSMENT	BOARD EXAMINATION	TOTAL	3 Hrs
			25	100*	100	

\* Examination will be conducted for 100 Marks and it will be reduced to 75 Marks

### 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.

### LIST OF EXPERIMENTS

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)

### N - SCHEME

(Implements from the Academic Year 2019-2020 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Subject Code : N - 5663

Semester : VI

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

#### TEACHING AND SCHEME OF EXAMINATIONS:

Number of Weeks per Semester: 14

SUBJECT	INSTRUCTIONS		EXAMINATIONS			DURATION
	HOURS / WEEK	HOURS / SEM	MARKS			
REFRIGERATION AND AIR CONDITIONING PRACTICAL	4	56	INTERNAL ASSESSMENT	BOARD EXAMINATION	TOTAL	3 Hrs
			25	100*	100	

\* Examination will be conducted for 100 Marks and it will be reduced to 75 Marks

#### 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.

## **LIST OF EXPERIMENTS**

### **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**

- To change refrigerant into service cylinder from storage cylinder.
- To evaluate the entire system
- To Pump down the system
- To Purge air from the system
- To locate the leaks in a system.
- To charge the system
- To check the oil level in the compressor.
- Tracing the common faults in R& A.C units and their remedies.

## N - SCHEME

(Implemented from the Academic Year 2019-2020 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Subject Code : N - 567

Semester : VI

Subject Title : **PROJECT WORK**

### TEACHING AND SCHEME OF EXAMINATIONS:

Number of Weeks per Semester: 14

SUBJECT	INSTRUCTIONS		EXAMINATIONS			DURATION
	HOURS / WEEK	HOURS / SEM	MARKS			
PROJECT WORK	4	56	INTERNAL ASSESSMENT	BOARD EXAMINATION	TOTAL	3 Hrs
			25	100*	100	

\* Examination will be conducted for 100 Marks and it will be reduced to 75 Marks

### 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.