STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

ANNEXURE – I

CURRICULUM OUTLINE

1020 DIPLOMA IN MECHANICAL ENGINEERING (FULL TIME)

III Semester

Subject Code	SUBJECT	HOURS PER WEEK			
		Theory hours	Drawing hours	Practical hours	Total hours
4020310	Strength of Materials	5	-	-	5
4020320	Manufacturing Technology - I	5	-	-	5
4020330	Measurements and Metrology	5	-	-	5
4020340	Thermal Engineering – I	5	-	-	5
4020350	Machine Drawing and CAD Practical	-	2	2	4
4020360	Manufacturing Technology – I Practical	-	-	4	4
4020370	Measurements and Metrology Practical	-	-	4	4
		20	2	10	32
Extra / Co-Curricular activities					
Library		-	-	-	1
Physical Education		-	-	-	2
TOTAL					**35**

ANNEXURE-II

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

SCHEME OF EXAMINATION

1020 DIPLOMA IN MECHANICAL ENGINEERING (FULL TIME)

III Semester

Subject Code	SUBJECT	Marks			Minimum marks for pass	Duration of ExamHours
		Internal Assessment	* Board Examination	Total		
4020310	Strength of Materials	25	100	100	40	3
4020320	Manufacturing Technology - I	25	100	100	40	3
4020330	Measurements and Metrology	25	100	100	40	3
4020340	Thermal Engineering – I	25	100	100	40	3
4020350	Machine Drawing and CAD Practical	25	100	100	50	3
4020360	Manufacturing Technology – I Practical	25	100	100	50	3
4020370	Measurements and Metrology Practical	25	100	100	50	3

* Examinations will be conducted for 100 Marks and will be converted 75 Marks.

STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : 1020 Diploma in Mechanical Engineering
Subject Code : 4020310
Semester : III
Subject Title : Strength of Materials

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4020310 Strength of Materials	5	80	25	100*	100	3 Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks for result.

Topics and Allocation of Hours

Unit No	Topics	Hours
I	Engineering Materials	15
II	Deformation of Metals	15
III	Geometrical Properties of Sections and Thin Shells	15
IV	Theory of Torsion and Springs	14
V	SF and BM Diagrams of Beams and Theory of Bending	14
Test and Model Exam		7
Total		**80**

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

- Acquire knowledge about materials properties.
- 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 load.

4020310 STRENGTH OF MATERIALS

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	**ENGINEERING MATERIALS** **Chapter: 1.1: Engineering materials:** Classification - definition of Mechanical properties - ferrous metals - cast iron - uses - advantages - types of cast iron - properties and applications - effect of impurities on cast iron. steel - classification - alloying elements - purpose of alloying - effect of alloying elements on steel - uses of steels - properties of mild steel - defects in steel - applications - properties of hard steel - market forms of steels – nonferrous metals - properties and uses. **Chapter: 1.2: Mechanical testing of materials:** Compression test - bend test - hardness test - Brinell hardness test, Vickers hardness test, Rockwell hardness test - impact test - fatigue test - creep test. Tensile test of mild steel in UTM - stress strain diagram -	7 6

	limit of proportionality - elastic limit - yield stress - breaking stress - ultimate stress - percentage of an elongation and percentage reduction in area - problems. **Chapter: 1.3: Friction** Introduction - definition - force of friction - limiting friction - static friction - dynamic friction - angle of friction - coefficient of friction - laws of static and dynamic friction. Description only.	2
II	**DEFORMATION OF METALS** **Chapter: 2.1: Simple stresses and strains** Definition - load, stress and strain - classification of force systems: tensile, compressive and shear force systems. 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 forces - simple problems in tension, compression and shear forces. **Chapter: 2.2: Elastic constants** Definition - lateral strain – poison's ratio - volumetric strain - bulk modulus - volumetric strain of rectangular and circular bars - problems connecting linear, lateral and volumetric deformations - elastic constants and their relationship - problems on elastic constants. Composite bar - definition - problems in composite bars subjected to tension and compression. Temperature stresses and strains - simple problems. **Chapter: 2.3 Strain Energy** Definition – proof resilience – modulus of resilience – the expression for strain energy stored in a bar due to axial load – instatntaneous stresses due to gradual, sudden, impact and shock loads – problems computing instantaneous stress and deformation in gradual, sudden, impact and shock loadings.	4 7 4
III	**GEOMETRICAL PROPERTIES OF SECTIONS AND THIN SHELLS** **Chapter: 3.1: Properties of sections** Definition – center of gravity and centroid - position of centroids of plane geometrical figures such as rectangle, triangle, circle and trapezium-problems to determine the centroid of angle, channel, T and I sections	8

	only – Definition - centroidal axis - Axis of symmetry. Moment of Inertia – parallel axis theorem and perpendicular axis theorem (statement only). Moment of Inertia of lamina of rectangle, circle, triangle, I and channel sections – Definition - Polar moment of Inertia - radius of gyration – Problems computing moment of inertia and radius of gyration for angle, T, Channel and I sections. **Chapter: 3.2: 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.	7
IV	**THEORY OF TORSION AND SPRINGS** **Chapter: 4.1: Theory of Torsion** Assumptions – torsion equation $\frac{T}{J} = \frac{f_s}{R} = \frac{C\theta}{l}$ - Strength of solid and hollow shafts – power transmitted – Definition – Polar modulus – Torsional rigidity – strength and stiffness of shafts – comparison of hollow and solid shafts in weight and strength considerations – Advantages of hollow shafts over solid shafts – Problems. **Chapter: 4.2: Springs** Types of springs – Laminated and coiled springs and applications — 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.	7 7
V	**SF AND BM DIAGRAMS OF BEAMS AND THEORY OF BENDING** **Chapter: 5.1: SF and BM diagrams** Classification of beams – Definition – shear force and Bending moment – sign conventions for shear force and bending moment – types of	7

	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. **Chapter: 5.2: Theory of bending** 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 simply supported beam.	7

Reference Books:

1. Strength of Materials, R. S. Khurmi, S.Chand & Co., Ram Nagar, New Delhi.
2. Strength of Materials, S. Ramamrutham, 15th Edition 2004, DhanpatRai Pub. Co., New Delhi.
3. Strength of Materials, R.K. Bansal, Laxmi Publications Pvt. Ltd., New Delhi, 3rd Edition, 2010.
4. Strength of materials, S.S.Rattan, Tata Mcgraw hill, New Delhi,2008, ISBN 9780070668959,
5. Strength of Materials, B K Sarkar, I Edition, 2003Tata Mcgraw hill, New Delhi.
6. Engineering mechanics, R.K. Bansal, Laxmi Publications Pvt. Ltd., New Delhi, 2nd Edition, 2007.

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STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N - SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : 1020 Diploma in Mechanical Engineering
Subject Code : 4020320
Semester : III
Subject Title : Manufacturing Technology - I

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4020320 Manufacturing Technology - I	5	80	25	100*	100	3 Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks for result.

Topics and Allocation of Hours

Unit No	Topics	Hours
I	Casting Processes	15
II	Joinng Processes	15
III	Bulk Deformation Processes and Heat Treatment	15
IV	Manufacturing of Plastic Componenets and Powder Metalurgy	15
V	Centre Lathe and Special Purpose Lathe	13
Test and Model Exam		7
Total		**80**

RATIONALE:

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

OBJECTIVES:

- 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.

4020320 MANUFACTURING TECHNOLOGY - I

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	**CASTING PROCESSES**	
	Chapter: 1.1: Patterns	3
	Definition – pattern materials – factors for selecting pattern materials – Types of Pattern - solid piece, split patterns, loose piece, match plate, sweep, skeleton, segmental, shell – pattern allowances – core prints.	
	Chapter: 1.2: Moulding	6
	Definition – moulding boxes, moulding sand – ingredients – silica – clay – moisture and miscellaneous materials – properties of moulding sand – sand additives – moulding sand preparation - moulding tools – mixing – tempering and conditioning – types of moulding – green sand – dry sand – machine moulding –Top and bottom squeezer machines – Jolting machines – sand slinger- core – CO_2 core making – types of core – core boxes.	

	Chapter: 1.3: Casting Definition – sand casting using green sand and dry sand – gravity die casting – pressure die casting – hot and cold chamber processes – centrifugal casting – continuous casting – chilled casting – malleable casting – melting of cast iron – cupola furnace – melting of nonferrous metals – crucible furnace melting of steel - arc furnaces – induction furnaces – instrument for measuring temperature – optical pyrometer – thermo electric pyrometer – cleaning of casting – tumbling, trimming, sand and shot blasting – defects in casting – causes and remedies – safety practices in foundry.	6
II	**JOINING PROCESSES** **Chapter: 2.1: Arc Welding** Definition – arc welding equipment – arc welding methods – carbon arc, metal arc, Metal Inert gas (MIG), Tungsten inert gas (TIG), Atomic hydrogen, Plasma arc, Submerged arc and Electro slag welding. **Chapter: 2.2: Gas welding** Definition Gas Welding Equipment– Oxy and acetylene welding - Three types of flame– resistance welding – classification of resistance welding – butt – spot – seam – projection welding – welding related processes – oxy and acetylene cutting – arc cutting – hard facing bronze welding – soldering and brazing special welding processes – cast iron welding – thermit welding – solid slate welding, ultrasonic, diffusion and explosive welding – explosive cladding – modern welding, electron beam and laser beam welding – types of welded joints – merits and demerits of welded joints – inspection and testing of welded joints – destructive and nondestructive types of tests – magnetic particle test – radiographic and ultrasonic test defects in welding – causes and remedies – safety practices in welding .	5 10
III	**BULK DEFORMATION PROCESSES AND HEAT TREATMENT** **Chapter: 3.1: Forming** Hot working, cold working – advantages of hot working and cold working– hot working operations – rolling, forging, smith forging, drop	7

	forging, upset forging, press forging – roll forging Press working : Types of presses – Mechanical and Hydraulic presses – press tool and accessories – press working operations – bending operations – angle bending – curling – drawing – shearing operations – blanking, piercing, trimming – notching – lancing. **Chapter: 3.2: Heat treatment** Heat treatment processes – purpose – procedures – applications of various heat treatment processes – Iron – carbon equilibrium diagram – full annealing – process annealing stress relief annealing - spherodising annealing – isothermal annealing – normalizing – hardening – tempering – quenching medium – different types and their relative merits – case hardening – pack carburizing – cyaniding – nitriding – induction hardening and flame hardening.	8
IV	**MANUFACTURING OF PLASTIC COMPONENTS AND POWDER METALLURGY** **Chapter: 4.1: Plastic Components** Types of plastics-Engineering plastics – thermosets – composite - structural foam, elastomers - polymer alloys and liquid crystal polymers. **Chapter: 4.2: Processing of Plastics** Extrusion-general features of single screw extrusion - twin screw extruders and types-Injection moulding types : Plunger type.- Reciprocating screw injection - details of injection mould - structural foam injection mould - sandwich moulding - gas injection moulding – injection moulding of thermosetting materials calendaring and rotational moulding. Design consideration for plastic components. **Chapter: 4.3: Powder Metallurgy** Methods of manufacturing metal powders – atomization, reduction and electrolysis deposition – compacting – sintering – sizing – infiltration – mechanical properties of parts made by powder metallurgy – design rules for the power metallurgy process.	3 6 6
V	**CENTRE LATHE AND SPECIAL PURPOSE LATHES** **Chapter: 5.1: Centre Lathe** Centre lathe: specifications – simple sketch with principal parts. Head	5

	stock: back geared type – all geared type - description only. Working principale of tumbler gear mechanism, quick change gear box, apron mechanism, carriage cross slide. Feed mechanism: automatic feed, longitudinal feed and cross feed. Construction and working of tail stock. work holding device: face plate – three jaw chuck – four jaw chuck – catch plate and carrier – center. Operations: straight turning – step turning - taper turning – knurling-Thread cutting - Facing – Boring – chamfering. Cutting speed – feed - depth of cut. **Chapter: 5.2: Semi-Automatic Lathes** Types of semi-automatic lathes – capstan and turret lathes – difference between turret and capstan. **Chapter: 5.3: Automatic Lathes** Automatic lathe – Construction and working principle of single spindle automatic lathe – automatic screw cutting machines – multi spindle automatic lathes.	4 4

Reference Books:

1. Elements of workshop Technology Volume I & II – Hajra Chowdry & Bhattacharaya - IIth Edition - Media Promoters & Publishers Pvt. Ltd., Seewai Building `B', 20-G, Noshir Bharucha Marg, Mumbai 400 007 – 2007.
2. Introduction of basic manufacturing processes and workshop technology – Rajendersingh – New age International (P) Ltd. Publishers, 4835/24, Ansari Road, Daryaganj, New Delhi – 110002.
3. Manufacturing process – Begeman - 5th Edition -McGraw Hill, New Delhi 1981.
4. Workshop Technology- WAJ Chapman - Volume I, II, & III – Vima Books Pvt. Ltd., 4262/3, Ansari Road, Daryaganj, New Delhi 110 002.
5. Workshop Technology – Raghuwanshi - Khanna Publishers. Jain & Gupta,
6. Production Technology, Edn. XII, Khanna Publishers, 2-B, North Market, NAI Sarak, New Delhi 110 006 - 2006
7. Production Technology - P. C. SHARMA - Edn. X - S.Chand & Co. Ltd., Ram Nagar, New Delhi 110 055 - 2006
8. Production Technology – HMT - Edn. 18 - published by Tata McGraw Hill publishing Co. Ltd., 7 West Patel nagar, New Delhi 110 008. – 2001.

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STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N - SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : 1020 Diploma in Mechanical Engineering
Subject Code : 4020330
Semester : III
Subject Title : Measurements and Metrology

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4020330 Measurements and Metrology	5	80	25	100*	100	3 Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks for result.

Topics and Allocation of Hours

Unit No	Topics	Hours
I	Basic Concepts of Measurements	15
II	Linear and Angular Measurements	15
III	Form Measurement	15
IV	Advances in Metrology	14
V	Measurement of Mechanical Parameters	14
Test and Model Exam		7
Total		**80**

RATIONALE:

Measurements and metrology are the basic and prominent tools in all the industries in the present scenario. The students should be trained not only in manufacturing also they should have knowledge about the various measuring instruments which is used in industries. This will provide the students an opportunity to skill themselves for how to handle the various metrological equipment available to measure the dimensions of the components.

OBJECTIVES

- Study about the basic concepts of measurements.
- Acquire knowledge about precision and accuracy.
- Describe about the various linear and angular measurements.
- Acquire knowledge about the measurement of screw threads and gears.
- Study about the laser metrology and computer in metrology.
- Describe the measurement of mechanical parameters force, power and flow.

4020330 MEASUREMENTS AND METROLOGY

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	**BASIC CONCEPTS OF MEASUREMENTS** **Chapter: 1.1: Introduction** Basic units - system concepts used in measuring technology - measuring instruments - length, angles and surface - scope of Metrology - standardization - international standardization, the bureau of Indian standards - legal Metrology - definition - applications - important elements of measurements - methods of measurements - needs for inspection - need for measurement - important terminology. **Chapter: 1.2: Precision and accuracy** Precision - definition - accuracy - definition - difference between precision and accuracy - factors affecting the accuracy of the measuring system - general rules for accurate measurements -	7 8

	precautions for use of instruments so as to avoid in accuracy in measurements - reliability - definition - error - definition - sources of errors - classification of error - compare systematic error and random error - selection of measuring instruments - symbols for metallurgical terms (ASME and ISO).	
II	**LINEAR AND ANGULAR MEASUREMENTS** **Chapter: 2.1: Linear measurements** Classification of linear measurement instrument - construction and the principles only - Steel rule - callipers - outside calliper, inside calliper, Jenny caliper - combination set - feeler gauge - pitch screw gauge - Vernier caliper - digital caliper - Vernier height gauge- micrometer - inside micrometer - thread micrometer - optical micrometer - light wave micrometer - possible sources of errors in micrometers - slip gauges - requirements - Indian standard - care and use. **Chapter: 2.2: Angular measurements** Introduction - vernier bevel protractor - universal bevel protractor - optical bevel protractor. Sine bar - types - uses and limitations - working principle of clinometer, autocollimator, angle dekkor. Comparators - uses - application - classification of comparator - mechanical comparator, optical comparator, electrical comparator, pneumatic comparator - principles - advantages and disadvantages - compare comparator with measuring instruments - compare electrical and mechanical comparators.	7 8
III	**FORM MEASUREMENT** **Chapter: 3.1: Measurement of screw threads** Screw thread terminology - error in thread - measurement of various elements of thread (description only) - thread gauges - classification - plug screw gauges, ring screw gauges, caliper gauges - adjustable thread gauge - gauging of taps - function of various types of gauges - floating carriage micrometer. **Chapter: 3.2: Measurement of gears** Introduction - types of gear - gear terminology - gear errors - spur	5 10

	gear measurement - run out, tooth measurement, profile measurement, lead checking , backlash checking, tooth thickness measurement - vernier gear tooth caliper - David brown tangent comparator - constant chord method - measurement of concentricity, alignment checking - Parkinson gear tester - Rolling gear testing machine - radius measurement - radius of circle - surface finish measurement - classification of geometrical irregularities - elements of surface texture - methods of measuring surface finish - measuring surface roughness - tracer type profilogram - double microscope.	
IV	**ADVANCES IN METROLOGY** **Chapter: 4.1: Laser Metrology** Basic concepts of lasers - types of lasers - uses, advantages and applications - laser telemetric system - laser and LED based distance measuring instruments - scanning laser gauge - photodiode array imaging - diffraction pattern technique - laser triangulation sensors - two frequency laser interferometer - gauging wire diameter from the diffraction pattern formed in laser - interferometry - use of laser in interferometry - interferometer - standard interferometer, single beam interferometer, AC interferometer, Michelson interferometer, dual frequency laser interferometer - Twyman green interferometer - applications. **Chapter: 4.2: Computer in Metrology** Coordinating measuring machine - introduction - types of measuring machines - types of CMM - futures of CMM - causes of errors in CMM - 3 co-ordinate measuring machine - performance of CMM - applications - advantages disadvantages - computer controlled coordinating measuring machine - mechanical system of computer controlled CMMs - trigger type probe system, measuring type prop system, features of CNC and CMM - features of CMM software - factors affecting CMM - digital devices - Computer based inspection - Computer aided inspection using robots.	7 7

V	**MEASUREMENT OF MECHANICAL PARAMETERS** **Chapter: 5.1: Force** Measurement of force - Direct methods - equal arm balance, unequal arm balance, multiple lever system, pendulum scale - indirect methods - electromagnetic balance - load cells - hydraulic load cell, pneumatic load cell, strain gauge load cell, shear type load cell, electronic weighing system. Torque measurement - torque measurement using strain gauge - laser optical torque measurement - stroboscope for torque measurement. **Chapter: 5.2: Measurement of power** Mechanical dynamometer - DC dynamometer - inductor dynamometer - hydraulic dynamometer - diaphragm pressure sensor - deform cage with LVDT - diaphragm gauge with strain gauges - piezoelectric sensors. **Chapter: 5.3: Measurement of flow** Types of flow metres - rotameter, electromagnetic flow metre, hot wire anemometer, ultrasonic flow metre, laser Doppler anemometer (LDA) - reference beam mode, interference French mode.	6 4 4

Reference Books:

1. Mechanical Measurements and Instrumentation, Rajput R K, S.K.Kataria and Sons.
2. Mechanical Measurement and Control, Jalgaonkar R.V, Everest Publishing House.
3. Mechanical and Industrial Measurements, Jain R K, Khanna Publications.
4. Instrumentation Devices and Systems, Narang C S, Tata McGraw Hill Publications.
5. Instrumentation, Measurement and Analysis, Nakra B.C, Chaudhary K.K, Tata McGraw Hill Publications.

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STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N - SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : 1020 Diploma in Mechanical Engineering
Subject Code : 4020340
Semester : III
Subject Title : Thermal Engineering - I

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4020340 Thermal Engineering - I	5	80	25	100*	100	3 Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks for result.

Topics and Allocation of Hours

Unit No	Topics	Hours
I	Basics of Thermodynamics and Thermodynamic processes of Perfect Gases	15
II	Thermodynamic Air Cycles and Heat Transfer	15
III	Internal Combustion Engines	15
IV	Fuels & Combustion of Fuels and Performance of IC Engines	15
V	Refrigeration and Air Conditioning	13
Test and Model Exam		7
Total		**80**

RATIONALE:

The growth of industries in the areas of Automobile and thermal power generation is the contemporary need of the present day. For these industries Knowledge on the concept of Thermodynamics, Thermodynamic Processes, Steady flow energy equation and study of fuels, IC Engines and performance of IC Engines are vital.

OBJECTIVES:

- Explain the basics of systems and laws of thermodynamic and
- Thermodynamic processes.
- Explain different type of fuels and their combustion phenomenon.
- Explain the types, functions and the performance tests of IC engines.
- Explain vapour compression refrigeration system.
- Explain vapour absorption refrigeration system.
- Compare the properties and applications of various refrigerants.
- Describe the equipment used for air conditioning.

4020340 THERMAL ENGINEERING - I

DETAILED SYLLABUS

Contents: Theory

Unit	Name Of The Topic	Hours
I	**BASICS OF THERMODYNAMICS AND THERMODYNAMIC PROCESSES OF PERFECT GASES** Introduction – definitions and units of mass, weight, volume, density, work –power- energy – types- 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 – 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. Description of basic concepts only.	5

	Perfect gases – laws of perfect gases – Boyle's, Charles', Joule's, Regnault's and Avogadro's laws –General Gas Equation-characteristic gas equation – relation between specific heats and gas constant – universal gas constant –Thermodynamic Processes-Change in Internal Energy- enthalpy –change in enthalpy – entropy – change in entropy – general equations for change in entropy. Description only.	5
	Constant volume, constant pressure, isothermal, isentropic (reversible adiabatic) – Description and problems. Polytropic (derivation only), hyperbolic (derivation only) – P-V and T-S diagrams, work done, change in internal energy, heat transfer, change in enthalpy, change in entropy for various processes - Free expansion and throttling processes.	5
II	**THERMODYNAMIC AIR CYCLES AND HEAT TRANSFER** Air cycles – air standard efficiency – reversible and irreversible processes –assumptions in deriving air standard efficiency – Carnot cycle – Otto cycle –Joule cycle – Diesel cycle – comparison of Otto cycle and Diesel cycle -Comparison of ideal and actual p-V diagrams of Otto and Diesel cycles –problems .	5
	Modes of heat transfer – heat transfer by conduction – Fourier's Law- – heat transfer by convection –heat exchanger – Parallel flow and Counter flow– heat transfer by radiation – Description only.	5
	Steady flow system – control volume – steady flow energy equation – assumptions –Engineering applications of steady flow energy equation – non flow energy equation. Description only.	5
III	**INTERNAL COMBUSTION ENGINES** Internal combustion engines. Classifications of I.C Engines – components of I.C Engines and functions material and method of manufacturing - four stroke cycle petrol and diesel engines – two stroke cycle 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	10

	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. Ignition systems – battery coil ignition systems – magneto ignition system - MPFI and CRDI System. Governing of I.C. engines - quantity and quality governing – cooling systems – air cooling – water cooling. Lubrication system – properties of lubricants –types of lubrication systems – high pressure Lubrication system - oil pump (Gear & Rotor Pumps) and oil filters.	5
IV	**FUELS &COMBUSTION OF FUELS AND PERFORMANCE OF I.C ENGINES** Classifications of fuels - merits and demerits – requirements of a good fuel –combustion equations – stoichiometric air required for complete combustion of fuels – excess air – products of combustion – analysis of exhaust gases - Exhaust gas analyser - calorific value of fuels – higher and lower calorific values – Dulong's formula – determination of calorific value – Bomb and Junker's calorimeter. Description only. 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 – heat balance sheet – procedure and problems.	15
V	**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. Bell-coleman cycle – Vapour compression refrigeration system - vapour absorption system – Comparision - refrigerants – properties. Description only. Psychrometry - psychometric properties – dry air – moist air – water vapour – saturated air – dry bulb temperature – wet bulb temperature – wet bulbdepression – dew point temperature – dew point	10 5

	depression – humidity – specific and relative humidity – psychrometric chart – psychrometric processes – sensible heating and cooling - By-pass Factor - humidification – dehumidification –Mixing of Air Stream. 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. Description only.	

Reference Books:

1. Thermal Engg, R.K.Rajput, 8th Edition, Laxmi publications Pvt Ltd , New Delhi.
2. Applied Thermodynamics, P.K. Nag, 2nd Edition, TATA Mcgraw – Hill Publishing Company, New Delhi .
3. Thermal Engineering, R.S. Khurmi and J.K. Gupta, 18th Edition, S. Chand & Co, New Delhi.
4. Thermal Engineering, P.L Ballaney , 24th Edition Khanna Publishers, New Delhi.
5. Thermal Engineering, B.K. Sarkar , 3rd Edition , Dhanpat Rai & Sons New Delhi .
6. Applied Thermodynamics, Domkundwar and C.P Kothandaraman, 2nd Edition Khanna publishers, New Delhi.

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STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N - SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : 1020 Diploma in Mechanical Engineering
Subject Code : 4020350
Semester : III
Subject Title : Machine Drawing and CAD Practical

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4020350 Machine Drawing and CAD Practical	4	64	25	100*	100	3 Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks for result.

RATIONALE:

Mechanical Engineering Diploma Engineer is expected to possess a thorough understanding of drawing, which includes clear visualization and proficiency in reading and interpreting a wide variety of production drawing. Manufacturing of various parts start from the basic drawing of components. The assembly of components is also carried out from the drawing. So drawing is an important subject to be studied by the students to carry and complete the production and assembly process successfully.

OBJECTIVES:

- To learn the parts and assembly of the machine components.
- To appreciate the need for sectional view and types of sections.
- To draw sectional views.
- To practice manual drawing

- To use Computer Aided Drafting.
- To prepare geometrical model of various machine elements.
- To draw the different views of machine elements.
- To interpret the drawing in engineering field and illustrate three dimensional objects.

4020350 MACHINE DRAWING AND CAD PRACTICAL

DETAILED SYLLABUS

Contents: Practical

PART–A: MANUAL DRAWING PRACTICE

Sectioning - sectional views – representation of sectional plane – hatching – inclination – spacing – hatching large areas – hatching adjacent parts - full section – half section – types of half sections – conventional representation of materials in section – Dimensioning.

Detailed drawings of the machine parts are given to students to assemble and draw any two views of the machine elements in the Drawing Sheet with dimensions. Front View /Full Section / Half SectionFront Viewand Top View / Left Side View / Right Side View.

PART–B: COMPUTER AIDED DRAFTING (CAD)

CAD applications – Hardware requirement – Software requirement – CAD screen interface – menus – Toolbars – types of co-ordinate system – Creating 2D objects – Using draw commands – Creating text – Drawing with precision – Osnap options – drafting settings – drawing aids – Fill, Snap, Grid, Ortho lines – Function keys – Editing and modify commands – Object selection methods – Erasing object – Oops – Cancelling and undoing a command – Copy – Move – Array – Offset – Scale – Rotate – Mirror – Break – Trim – Extend – Explode. Divide – Measure – stretch – Lengthen – Changing properties – Color – line types – LTscale – Matching properties – Editing with grips – Pedit – Ddedit – Mledit - Basic dimensioning – Editing dimensions – Dimension styles – Dimension system variables. Machine drawing with CAD. Creation of blocks – Wblock – inserting a block – Block attributes – Hatching – Pattern types – Boundary hatch – working with layers – Controlling the drawing display – Blipmode – View group commands – Zoom, redraw, regen,

regenauto, pan, viewers – Realtime zoom. Inquiry groups – calculating area – Distance – Time – Status ofdrawing – Using calculator. Plot

Detailed drawings of the machine parts are given to students to assemble and create two views of the machine elements in the CAD package with dimensions. Front View / Sectional Front View (Full Section / Half Section) and Top View / Left Side View / Right Side View.

EXERCISE:

Draw the Front View / Sectional Front View (Full Section / Half Section) and Top View / Left Side View / Right Side View for the following given part drawing of the components after assemble in the drawing sheet and CAD package.

1. Sleeve & Cotter joint
2. Screw jack
3. Plummer Block
4. Simple Eccentric
5. Machine Vice
6. Protected type flanged coupling

Reference Books:

1. A Textbook of Machine Drawing, Pritam Singh Gill, S.K.Kataria & Sons.
2. Machine Drawing, N.D.Bhatt, V.M.Panchal, Charoter Publishing House.
3. Introducing Autocad 2010 and Autocad LT 2010, George Omura, Wiley India Pvt. Ltd.
4. A Textbook of Engineering Drawing, R.B.Gupta, Satya Prakasan, Technical India Publications.
5. Engineering Drawing, D.N. Ghose, Dhanpat Rai &Sons, Delhi

Internal Mark Allocation

Note:

All the students should maintain the observation cum record note book / manual as per the regulation. The printout of the actual CAD output created by the student during practice should be pasted for every exercise in the observation cum record note work.

For every exercise, manual drawing sheet (Two views) should be submitted and evaluated for 50 Marks. (Front view – 30 Marks and Top view/Side view – 20 Marks). The average of the six exercises should be converted to 10 Marks.

Drawing Sheet (Six Exercise Average)	-	10 Mark
Observation and Record work	-	10 Mark
Attendance	-	05 Marks
Total	**-**	**25 Marks**

BOARD EXAMINATION

Note: All the exercises should be completed by Manual and CAD. All the exercise should be given for examination, the students are permitted to select by lot or the question paper from DOTE should be followed. Observation cum Record note book should be submitted during examination along with the drawing file. Part A and Part B should be completed for the examination.

PART A: Manual Drawing in the Drawing sheet

Draw the assemble Front View / Sectional Front View (Full Section / Half Section) for the given part drawing of the components in the drawing sheet.

PART B: Computer Aided Drafting in the CAD package

Create the assemble Front View / Sectional Front View (Full Section / Half Section) and Top View / Left Side View / Right Side View for the given part drawing of the components in any one of the CAD package.

DETAILLED ALLOCATION OF MARKS

Manual Drawing in Drawing sheet		**: 30 marks**
Assemble Front view	30	
Computer Aided Drafting		**: 60 marks**
Drafting	20	
Assembly	20	
Dimensioning	20	
Viva-voce		**: 10 marks**
Total		**: 100 marks**

LIST OF EQUIPMENT

(To accommodate a batch of 30 students in Practice / Board Examinations)

1. Personal computer – 30 Nos.
2. Printer – 1 No.
3. Required Software's: CAD Package – Sufficient to the strength.

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STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N - SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : 1020 Diploma in Mechanical Engineering
Subject Code : 4020360
Semester : III
Subject Title : Manufacturing Technology - I Practical

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4020360 Manufacturing Technology - I Practical	4	64	25	100*	100	3 Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks for result.

OBJECTIVES:

- Identify the parts of a center lathe
- Identify the work holding devices
- Set the tools for various operations
- Operate the lathe and Machine a component using lathe
- Identify the tools used in foundry.
- Identify the tools and equipments used in welding
- Prepare sand moulds for different patterns.
- Perform welding operation to make different types of joints.
- Identify the different welding defects.
- Appropriate the safety practices used in welding

4020360 MANUFACTURING TECHNOLOGY - I PRACTICAL

DETAILED SYLLABUS

Contents: Practical

Lathe: Study of Lathe parts and its fuctions – Operations - Plain Turning , Step Turning, Taper turning, Knurling, Thread cutting, Bushing, Ecentric Turning

Foundry: Study of foundry - green sand – properties – patterns – Types - Solid Pattern - Stepped pulley, Bearing top, Gear wheel. Split Pattern - T Pipe, Bent Pipes, Dumbles - Loose Piece pattern – Dovetail – Core – Cores sand - Cylindrical core making

Welding Exercises

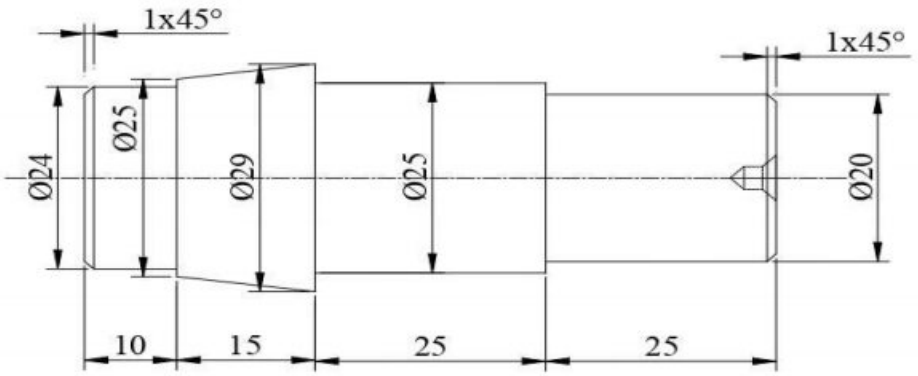
Arc welding principles and components - Arc Welding - Lap Joint - Butt Joint, T Joint, Corner joint. Gas welding equipments – components - Gas welding - Lap Joint, Butt Joint, T Joint, Corner Joint. Gas cutting - Spot Welding

Exercises

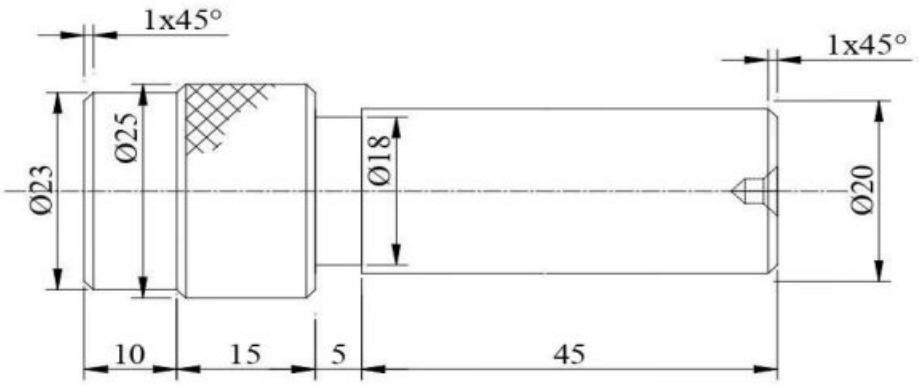
PART A – Lathe Exercises

Note: All Dimensions are in mm. All linear dimensions in ± 0.5mm tolerance. All cylindrical dimensions in ± 0.2mm tolerance.Estimate the cost of the job for following exercises for M.S. round rod with suitable raw material for the final size. Final job of the raw material should be retained for verification. (student wise or batch wise).

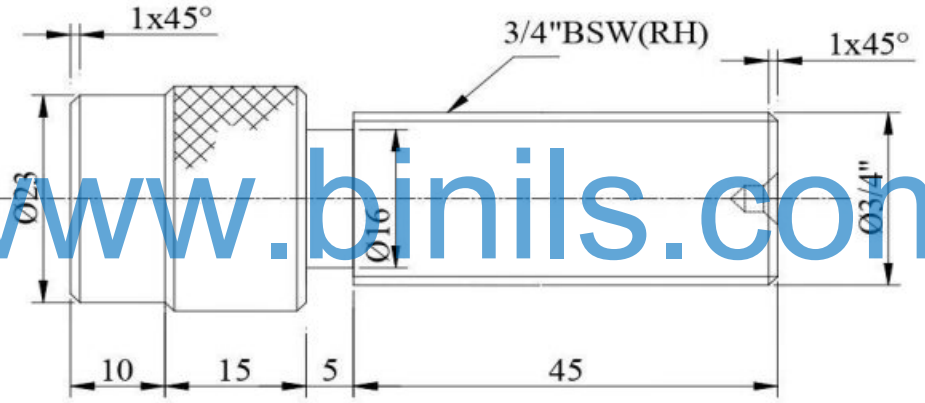
1. Prepare the specimen and make the Step turning & Taper turning as shown in figure using the Lathe.



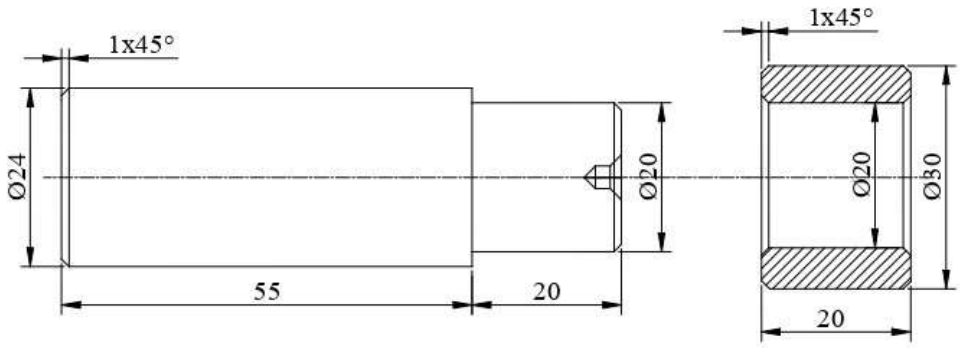
2. Prepare the specimen and make the Step turning & Knurling as shown in figure using the Lathe.



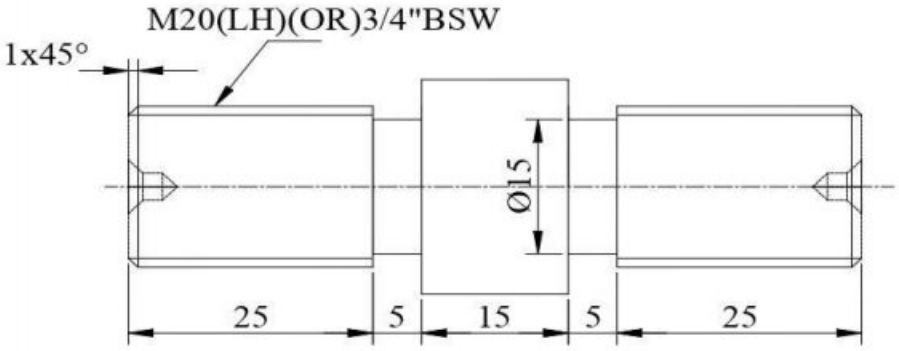
3. Prepare the specimen and make the Step turning &BSW Thread cutting as shown in figure using the Lathe.



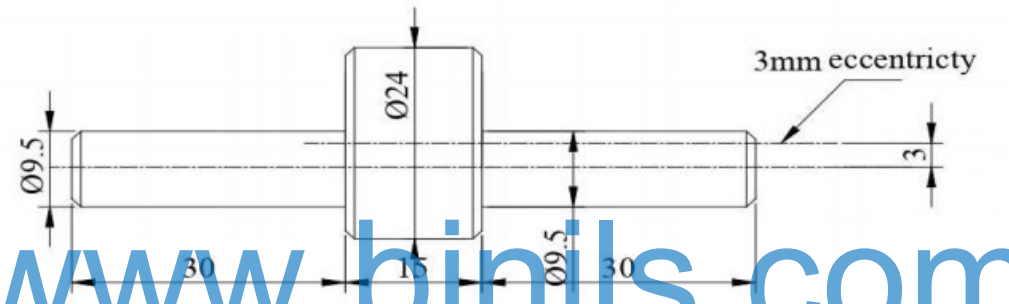
4. Prepare the specimen and make the Shaft and Bush as shown in figure using the Lathe.



5. Prepare the specimen and make the Step turning & BSW and Metric Thread cutting as shown in figure using the Lathe.



6. Prepare the specimen and make the Eccentric turning as shown in figure using the Lathe.



PART B – Exercises

1. Prepare the green sand moulding using any one Solid Pattern in the foundry.
2. Prepare the green sand moulding using any one Split Pattern in the foundry.
3. Prepare the green sand moulding using any one Loose Piece pattern in the foundry.
4. Prepare the specimen and make the Lap joint by the Arc Welding (Both side welded). (Raw material 25mm X 6mm MS flat)
5. Prepare the specimen and make the corner joint by the Gas Welding. (Raw material 25mm X 3mm MS sheet)
6. Prepare the specimen and make the joint by the Spot welding.

BOARD EXAMINATION

Note:

- All the exercises in both sections have to be completed. Two exercises will be given for examination by selecting one exercise from PART A and one exercise from PART B.
- All the exercises should be given in the question paper and students are allowed to select by a lot or Question paper issued from the DOTE should be followed.
- All regular students appearing for first attempt should submit record notebook for the examination.
- The external examiner should verify the availability of the facility for the batch strength before commencement of practical examination.
- The external examiner should verify the working condition of machinery's / equipment before commencement of practical examination.

DETAILED ALLOCATION OF MARKS

Part - A	**:**	**55 marks**
Procedure / Preparation	10	
Machining / Dimensions	35	
Finishing	10	
Part - B	**:**	**40 marks**
Procedure / Preparation	10	
Machining / Dimensions	25	
Finishing	5	
Viva voce	**:**	**05 marks**
Total	**:**	**100Marks**

LIST OF EQUIPMENT

(To accommodate a batch of 30 students in Practice / Board Examinations)

1. Center Lathe 4 ½ ‘ Bed length – 10 No’s
2. 4 Jaw / 3 Jaw Chucks – required Numbers
3. Chuck key (10 mm x 10 mm size) – 10 No’s
4. Box spanner – 1 No’s
5. Cutting Tool H.S.S ¼ ‘’ X ¼ ‘’ X 4 ‘’ long – 10 No’s
6. Pitch gauge – 5 Nos
7. Vernier Caliper (0-25 and 25-50) – 5 Nos each
8. Micrometer, Inside and Outside(0-25 and 25-50) - 5 each
9. Vernier Height Gauge(300mm) - 1 no
10. Snap gauge – 1 set
11. Gear tooth Vernier - 1 No
12. Parallel Block - 2 Nos
13. Steel Rule (0-150) – 10 Nos.
14. Outside and Inside Calipers - 10 Nos. each
15. Thread gauge – 5 Nos.
16. Bevel Protractor – 1 No
17. Jenny Caliper – 5 Nos.
18. Dial Gauge with Magnetic Stand – 5 Nos.
19. Marking Gauge – 10 Nos.
20. Safety Glass – 10 Nos.
21. Arc welding booth – 2 No’s
    with oil /air cooledwelding transformer withaccessories
22. Gas welding unit (Oxygen and acetylene cylinder) – 1 Set
23. Flux – 500 g
24. Electrode 10 SWG – 200 No’s
25. Face shield – 3 No’s
26. Gas welding goggles – 2 No’s
27. Leather Glows 18’’ – 4 Set
28. Flux chipping hammer – 4 No’s
29. Spot welding machine - 1 No

30. Shovel	- 10 Nos
31. Rammer set	- 10 Nos
32. Slick	- 10 Nos
33. Strike-off bar	- 10 Nos
34. Riddle	- 10 Nos
35. Trowl	- 10 Nos
36. Lifter	- 10 Nos
37. Sprue pin	- 20 Nos
38. Brush	- 10 Nos
39. Vent rod	- 10 Nos
40. Draw spike	- 10 Nos
41. Gate cutter	- 10 Nos
42. Cope box	- 10 Nos
43. Drag box	- 10 Nos
44. Core box	- 10 Nos
45. Runner & riser	- 20 Nos
46. Moulding board	- 10 Nos
47. Patterns	- 5 Nos each

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STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU
DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N - SCHEME

(To be implemented for the students admitted from the year 2020 - 2021 onwards)

Course Name : 1020 Diploma in Mechanical Engineering
Subject Code : 4020370
Semester : III
Subject Title : Measurements and Metrology Practical

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
			Marks			Duration
	Hours / Week	Hours / Semester	Internal Assessment	Board Examinations	Total	
4020370 Measurements and Metrology Practical	4	64	25	100*	100	3 Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks for result.

OBJECTIVES:

- Familiarize about measuring techniques of Metrology instruments.
- Select the range of measuring tools. Study of accuracy of instruments and calibration of instruments.
- Obtain accurate measurements.
- Determine the least count of measuring instruments.
- Acquire knowledge about linear measurement.
- Acquire knowledge about angular measurement.
- Acquire knowledge about geometric measurements.
- Study of Linear Measuring Instruments: Vernier Caliper, Micrometer, Inside Micrometer, Vernier Height gauge and Slip Gauge.
- Study of Angular Measuring Instruments–Universal Bevel Protractor, Sine Bar.
- Study of Geometric measurement - Gear tooth Vernier, Thread Vernier.

Exercises

PART A:

1. Measure the dimensions of ground MS flat / cylindrical bush using VernierCaliper 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 inside diameter of the bore of a bush cylindrical component using inside micrometer compare the result with digital micro meter.
5. Measure the height of gauge blocks or parallel bars using vernier height gauge.
6. Detect of cracks of the given two specimens using liquid penetrant test and magnetic particle test.

PART B:

1. Measure the angle of a V-block / Taper Shank of Drill / Dovetail using universal bevel protractor.
2. Measure the angle of the machined surface using sine bar with slip gauges.
3. Measure the geometrical dimensions of V-Thread using thread micrometer.
4. Measure the geometrical dimensions of spur gear.
5. Find out the measurement of given component and compare with a standard component using mechanical comparator and slip gauge .
6. Prepare a specimen to examine and find the grain structure using the Metallurgical Microscope.

BOARD EXAMINATION

Note:

- All the exercises in both sections have to be completed. Two exercises will be given for examination by selecting one exercise from PART A and one exercise from PART B.
- All the exercises should be given in the question paper and students are allowed to select by a lot or Question paper issued from the DOTE should be followed.
- All regular students appearing for first attempt should submit record notebook for the examination.
- The external examiner should verify the availability of the facility for the batch strength before commencement of practical examination.
- The external examiner should verify the working condition of machinery's / equipment before commencement of practical examination.

DETAILED ALLOCATION OF MARKS

Part-A	:	**45 marks**
Procedure / Preparation	10	
Observation / Dimensions	25	
Finishing	10	
Part-B	:	**45 marks**
Procedure / Preparation	10	
Observation / Dimensions	25	
Finishing	10	
Viva-voce	:	**10 marks**
Total	:	**100Marks**

LIST OF EQUIPMENTS

(To accommodate a batch of 30 students in Practice / Board Examinations)

1. Vernier Caliper - 2 Nos.
2. Digital / Dial Vernier Caliper. - 2 Nos.
3. Outside micrometer - 2 Nos.
4. Inside Micrometer - 2 Nos
5. Digital Micrometer - 2 Nos.
6. Slip gauges - 2 Nos.
7. Universal bevel protractor. - 2 Nos.
8. Sine bar - 2 Nos.
9. Digital inside micrometer - 2 Nos.
10. Surface plate - 2 Nos.
11. Vernier height gauge - 1No.
12. Thread Vernier - 1 No.
13. Thread micrometer – 1 No.
14. Gear tooth Vernier - 2 Nos.
15. Mechanical comparator - 2 Nos.
16. Dial indicator (0-10) - 2 Nos.
17. Abrasive grinder – 1 No.
18. Polishing Machine – 1 No.
19. Mounting machine – 1 No.
20. Metallurgical microscope – 2 Nos
21. Magnetic yoke - 1 No.
22. Liquid penetrant test kit – 1 set.
23. Consumable - Sufficient quantity