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ANNEXURE I

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU

DIPLOMA IN AUTOMOBILE ENGINEERING SYLLABUS

N-SCHEME

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

CURRICULUM OUTLINE

THIRD SEMESTER

Col. No.	Subject Code	Subject	Hours Per Week			
			Theory	Drawing	Practical	Total
1	4021310	Mechanics of Materials and Material Science	5	-	-	5
2	4021320	Production Technology	5	-	-	5
3	4020330	Measurements and Metrology *	5	-	-	5
4	4021340	Fluid Mechanics and Pneumatics	5	-	-	5
5	4021350	Material Testing and Fluids Mechanics & Pneumatics Practical	-	-	4	4
6	4021360	Production Technology Practical	-	-	4	4
7	4020370	Measurements and Metrology Practical *	-	-	4	4
			20	-	12	32
Extra / Co-Curricular activities		Physical Education	-	-	-	2
		Library	-	-	-	1
Total						35

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* Common with Mechanical Engineering

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ANNEXURE II

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU

DIPLOMA IN AUTOMOBILE ENGINEERING SYLLABUS

N-SCHEME

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

SCHEME OF EXAMINATION

1021 DIPLOMA IN AUTOMOBILE ENGINEERING (FULL TIME)

III Semester

Subject Code	Subject	Marks			Minimum marks for pass	Duration of Exam Hours
		Internal Assessment	Board Examination#	Total		
4021310	Mechanics of Materials and Material Science	25	100	100	40	3
4021320	Production Technology	25	100	100	40	3
4020330	Measurements and Metrology *	25	100	100	40	3
4021340	Fluid Mechanics and Pneumatics	25	100	100	40	3
4021350	Material Testing and Fluids Mechanics & Pneumatics Practical	25	100	100	50	3
4021360	Production Technology Practical	25	100	100	50	3
4020370	Measurements and Metrology Practical *	25	100	100	50	3

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* Common with Mechanical Engineering

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

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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 : 1021 Diploma in Automobile Engineering
Subject Code : 4021310
Semester : III
Subject Title : Mechanics of Materials and Material Science

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	
4021310 Mechanics of Materials and Material Science	5	80	25	100*	100	3 Hrs.

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

Topics and Allocation of Hours

Unit	Topics	Hours
I	Properties of Materials and Heat Treatment of Metals	13
II	Materials Processes, Ferrous, Non Ferrous Metals, Non-Metallic Materials and Special Materials.	13
III	Direct Stresses and Strains, Geometrical Properties of Sections	16
IV	Shear Force and Bending Moments, Friction	16
V	Torsion of Shaft and springs	15
Test & Revision		7
Total		80

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RATIONALE:

Mechanics of Materials and Material Science is a core subject which aims at enabling the student to understand and analyze various materials used in automobile industry and types of load, stress and strain along with main causes of change in physical properties. All Automobile parts are subjected to different loading and behave in specific way. The subject is pre-requisite for understanding principle of machine design and strengths of various materials used in automobile industries. Understanding the mechanical properties of materials will help in selecting the suitable materials for automobile engineering applications.

OBJECTIVES:

At the end of the course, the students will be able to

- Determine the simple stress and strain for the engineering materials subject to tension, compression and shear load
- Determine the moment of Inertia of various sections used in industries.
- Define and explain the law of forces and friction.
- Draw the shear force and bending moments diagram of the beam for different loading
- Assess the effect of load on the torsion of shaft and spring.
- State various mechanical properties of materials.
- Describe the plastic deformation of the metals
- Describe the various heat treatment process for engineering materials
- Explain the processing of materials and non-metallic materials.
- Explain the various materials used in automobile components

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4021310 - MECHANICS OF MATERIALS AND MATERIAL SCIENCE

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	**PROPERTIES OF MATERIAL AND HEAT TREATMENT OF METALS** **1.1: Properties of material** Definition of mechanical properties – Compressive strength, tensile strength, ductility, brittleness, hardness, toughness, malleability, impact strength, stiffness, fatigue, creep, Endurance limit, cyclic loading, repeated loading and fatigue loading. Atomic structure – Bonds – Primary bond and Secondary bonds – Crystals – Cubic structure – Simple Cubic structure, body centred Cubic structure – face centred Cubic structure Hexagonal closed packed structure –deformation of metal – Elastic and plastic deformation – Stress-strain diagram of ductile and brittle material – Slip and Twinning – Strain Hardening. **1.2: Heat Treatment of Metals:** Heat treatment of metals –Cooling curve for solidification of pure metal – Phase diagram –Iron-carbon phase diagram – critical temperature on heating and cooling – cooling curve for pure iron –Normalizing, annealing hardening – Nitriding, cyaniding, carbonitriding, age hardening, flame and induction hardening. Description only	7 6
II	**MATERIALS PROCESSES, FERROUS, NON FERROUS METALS, NON METALLIC MATERIALS AND SPECIAL MATERIALS.** **2.1: Materials processes** Introduction - approaches to material processes – materials process steps - process of metals – process of glass - process of polymers. **2.2 : Ferrous and Non Ferrous metals** Properties and automobile applications of Cast iron, Plain carbon steel, High Strength steel and Stainless steel. Alloy steel - need of alloying, alloying elements, effect of alloying on properties, automobile application - Aluminium alloy - Copper alloy **2.3 : Non metallic materials and Special materials:** Non metallic materials – composition, characteristics and automobile application of plastics, Polymer matrix composites and glass.	3 6 4

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	Introduction and automotive applications of Smart materials & Nanomaterials.	
III	**DIRECT STRESSES AND STRAINS, GEOMETRICAL PROPERTIES OF SECTIONS** **3.1: Direct Stresses and Strains** Introduction - Definition and explanation of tensile, compressive, shear, stress and strain - behaviour of ductile material under tension– limit of proportionality, elastic limit, yield point, breaking point, ultimate stress, percentage elongation and percentage reduction in area - problems – Hooke's law – Young's modulus – working stress – factor of safety - bars of varying section – shear stress and shear strain – modulus of rigidity – problems in tension, compression and shear. Lateral strain – Poisson's ratio – volumetric strain – bulk modulus – elastic constants and their relationship – problems connecting lateral, linear and volumetric deformation – problems on elastic constants. **3.2: Geometrical properties of sections** Introduction - centre of gravity – centroid – position of centroids of plane geometrical figures such as rectangle, triangle, circle and trapezium – determination of centroid of angles, channels, I and T sections – problems – moment of inertia – definition – parallel axes theorem – perpendicular axes theorem - M.I of angle, channel, I and T sections - no derivations required – polar moment of inertia – radius of gyration – problems.	**8** **8**
IV	**SHEAR FORCE AND BENDING MOMENTS, THEORY OF BENDING AND FRICTION** **4.1: Shear Force and Bending Moments:** Introduction – classification of beams – definition - shear force - bending moment – sign convention – types of loads – relation between load, shear force and bending moment – shear force diagram and bending moment diagram of cantilever and simply supported beam subjected to concentrated load and uniform distributed load only – maximum Bending moment - problems on shear force diagram and bending moment diagram for cantilever and simply supported beam only.	**9**

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	4.2: Theory of Bending Theory of simple bending – derivation of bending equation $\frac{M}{I} = \frac{f}{y} = \frac{E}{R}$, and assumptions used – neutral axis - bending stress distribution – moment of resistance – simple problem. **4.3 : Friction** Friction – force of friction – limiting friction – static friction – dynamic friction – laws of static and dynamic friction – angle of friction – co-efficient of friction.	**5** **2**
V	**TORSION OF SHAFT AND SPRINGS** **5.1: Torsion of Shaft:** 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. **5.2: Springs:** 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	**8** **7**

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Reference Books

1. R. S. Khurmi," Strength of Materials" S.Chand Publication, Ram Nagar, New Delhi
2. R.K.Rajput," Strength of Materials" S.Chand Publication, Ram Nagar, New Delhi
3. S.S.Rattan, "Strength of materials", Tata McGraw hill, New Delhi
4. R.K. Bansal, "Strength of Materials", Laxmi Publications Pvt. Ltd., New Delhi
5. N. Khurmi & R S Khurmi, "Applied Mechanics" S.Chand Publication ,Ram Nagar, New Delhi.
6. William F Smith, Javad Hashemi and Ravi Prakash, "Material Science and Engineering", McGraw Hill Education, Noida

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7. Jason Rowe “Advanced Materials in Automotive Engineering” Woodhead Publishing
8. Brain Cantor, Patric Grant and Colin Johnston, “ Automobile Engineering -Light weight, Functional and novel material, Taylor & Francis Group, New York and London
9. James Maxwell, “Plastics in the Automotive Industry”, Woodhead Publishing
10. Lorraine F. Francis, “Materials Processing - A Unified Approach to Processing of Metals, Ceramics and Polymers” Academic Press is an imprint of Elsevier.
11. S Sedha and R.SKhurmi, “Material science”, S.Chand & Co ,Ram Nagar, New Delhi

Reference Web Link / Video

Topic	Website	Link
Strength of Materials	Dote E-Lecture	https://www.youtube.com/watch?v=IT-3In1szHY&list=PL1b9Ht9lSqlFInLTS7xxQ6dRdIp4Jc8Vh
Strength of Materials	NPTEL	https://nptel.ac.in/noc/courses/noc21/SEM2/noc21-ce38/
Basics of Materials Engineering	NPTEL	https://nptel.ac.in/noc/courses/noc21/SEM2/noc21-me113/
Materials Science	NPTEL	https://nptel.ac.in/courses/112/108/112108150/

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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 : 1021 Diploma in Automobile Engineering
Subject Code : 4021320
Semester : III
Subject Title : Production Technology

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	
4021320 Production Technology	5	80	25	100*	100	3 Hrs.

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

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Topics and Allocation of Hours

Unit	Topics	Hours
I	Foundry Technology, Forging	14
II	Welding Technology	14
III	Theory of metal cutting and Centre Lathe, Shaper	15
IV	Milling Machines and Drilling Machines	15
V	Grinding and CNC Machines	15
Test & Revision		7
Total		80

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RATIONALE

Production Technology is a core subject. A diploma holder of Automobile engineering should be proficient in the use of manufacturing processes available. In the process of manufacturing we should possess adequate and through knowledge about the working of conventional as well as non-conventional machines. The topics included in this subject aims the skills of metal cutting, milling, grinding, and other machining processes which are very much essential for a technician. This will provide the students an opportunity to skill themselves for the industrial scenario.

OBJECTIVES

Students must be able to:

- 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 forging technologies.
- Acquire knowledge about theory of metal cutting.
- Knowledge about the lathe and its working parts.
- Study the working of various machine tools: Shaper and milling.
- Study the milling procedure for spur helical and bevel gears.
- Study the various types of gear generating processes
- Study about the drilling process.
- Study the different types of grinders and grinding wheels.
- Study about the components and working CNC Turning and Milling machines.

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4021320 PRODUCTION TECHNOLOGY
DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topic	Hours
I	**Foundry Technology:** Introduction – Pattern: Definition – types of patterns: Solid, Split, Loose piece, Skeleton. Pattern materials – pattern allowances. Properties of moulding sand – List the major moulding tools and its description. Green sand moulding process. Moulding machines: construction and working principle of Jolt machine, Squeezer, Sand slinger. Core – core sand – properties. CO_2 process core making. Construction and working principle of Cupola furnace, Electric arc furnace and induction furnace. Casting: Introduction - Working principle of centrifugal casting – continuous casting. Defects in casting – causes and remedies.	11
	Forging: Hot working, cold working – comparison and advantages. Description of rolling, drawing, bending, coining, embossing, extrusion, drop forging, upset forging, press forging.	3
II	**Welding Technology: Arc Welding:** Introduction – electrode -filler and flux materials –types of welding - Working principle, applications, advantages and disadvantages of Metal arc welding, Metal Inert gas (MIG) welding, Tungsten inert gas (TIG) welding, Submerged arc welding, Electro slag welding.	7
	Gas welding: Gas welding equipment - Types of flames – welding techniques – filler rods - Flame cutting. Working principle of Oxy-acetylene welding – advantages – limitations. 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.	7
III	**Theory of metal cutting:** Introduction – orthogonal cutting – oblique cutting - single point cutting tool – nomenclature – cutting tool materials – properties – tool wears – factors affecting tool life – cutting fluids.	3
	Centre Lathe: Introduction - specifications – simple sketch with	9

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	principal parts. Construction and working of head stock – back geared type – all geared type. Feed mechanism - tumbler gear mechanism – quick change gear box – apron mechanism. Machining operations: straight turning – step turning - taper turning by different methods - thread cutting – boring – eccentric turning. Description of cutting speed – feed - depth of cut - metal removal rate. Work holding devices. **Shaper:** Introduction – specifications – principles of operations standard shaper – quick return mechanism - crank and slotted link – hydraulic shaper - feed mechanism.	**3**
IV	**Milling Machines:** Types - column and knee type – universal 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. Nomenclature of cylindrical milling cutter. Milling operations: straddle milling - gang milling - vertical milling attachment. Dividing head - indexing plate - linear indexing – simple indexing -compound indexing. Procedure for spur, helical and bevel gears. Generating Process: Gear shaper - gear hobbing - principle of operation only. Gear finishing processes: burnishing – shaving - grinding and lapping. **Drilling Machines:** Drilling machine: bench type - floor type - radial type - gang drill – multi spindle type –Working principle of upright drilling machine and radial drilling machine. Drills - flat drills - twist drills – nomenclature of twist drill. Tool holding devices: drill chucks - socket and sleeve. Operation: Drilling - reaming - counter sinking - counter boring - spot facing – tapping - deep hole drilling.	**10** **5**
V	**Grinding:** Types and classification – working principle of pedestal grinders- cylindrical grinder - centerless grinders – surface grinder - tool and cutter grinder. Grinding wheels – abrasives - natural and artificial diamond wheels - 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 -	**8**

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	Dressing and Truing of wheels - Balancing of grinding wheels. **CNC machines:** Introduction – CNC turning machines – working principles of CNC slant bed turning centre. Tool holders – wok holding collets. CNC milling machines: Working principles of vertical machining centre – Tool holders – Work holder – Automatic tool changer. Coordinate Measuring Machine – Principle of operation.	**7**

Reference Books

1. Elements of workshop Technology Volume I & II – Hajra Chowdry & Bhattacharaya - IIth Edition - Media Promoters & Publishers Pvt. Ltd.
2. Introduction of basic manufacturing processes and workshop technology – Rajendersingh – New age International (P) Ltd. Publishers
3. Manufacturing process – Begeman - 5th Edition -McGraw Hill.
4. Workshop Technology- WAJ Chapman - Volume I, II, & III – Vima Books Pvt. Ltd.
5. Workshop Technology – Raghuwanshi - Khanna Publishers.
6. Production Technology, Edn. XII, Khanna Publishers.
7. Production Technology - P. C. SHARMA - Edn. X - S.Chand& Co. Ltd.
8. Production Technology – HMT - Edn. 18 - published by Tata McGraw Hill publishing Co. Ltd

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Reference Web Link / Video

Topic	Website	Link
Fundamentals of manufacturing processes	NPTEL	https://nptel.ac.in/courses/112/107/112107219/
Manufacturing Processes I	NPTEL	https://nptel.ac.in/courses/112/107/112107144/
Manufacturing Processes II	NPTEL	https://nptel.ac.in/courses/112/105/112105127/

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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 : 1021 Diploma in Automobile 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.

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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**

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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.

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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	7 8

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	measuring system - general rules for accurate measurements - 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.	7
	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.	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.	5

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	Chapter: 3.2: Measurement of gears Introduction - types of gear - gear terminology - gear errors - spur 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.	10
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

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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

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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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Reference Web Link / Video

Topic	Website	Link
Engineering Metrology	NPTEL	https://nptel.ac.in/courses/112/104/112104250/
Metrology	NPTEL	https://nptel.ac.in/courses/112/106/112106179/

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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 : 1021 Diploma in Automobile Engineering
Subject Code : 4021340
Semester : III
Subject Title : Fluid Mechanics and Pneumatics

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	
4021340 Fluid Mechanics and Pneumatics	5	80	25	100*	100	3 Hrs.

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

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Topics and Allocation of Hours

Unit	Topics	Hours
I	Properties of Fluid and Fluid Static	15
II	Fluid Dynamic, kinematics and Hydraulic Machinery's	15
III	Hydraulic systems and its components	14
IV	Hydraulic circuits and hydro-pneumatics	14
V	Pneumatic Systems, components and circuits	15
Test & Revision		7
Total		80

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RATIONALE

Knowledge of fluid properties, fluid flow, hydraulic and pneumatic is essential in all fields of engineering. Fluid mechanics and pneumatics have important role in the automobile application like lubrication system, cooling system, combustion process etc., and also in most of the automated industry applications. This subject requires knowledge of basic engineering sciences, applied mechanics, mathematics etc.

OBJECTIVES

At the end of the course, the students will be able

- Define various properties of fluids
- State and explain Pascal's law and its applications
- Explain the working of pressure measuring devices
- State continuity equation, Bernoulli's equation and its applications.
- Estimate various losses in flow through pipes.
- Draw the construction, working of hydraulic pumps and turbines.
- Explain the elements of pneumatics system
- Draw pneumatic circuits for industrial application
- Draw hydraulic circuits for industrial application
- State the important of hydro-pneumatic systems
- Compare pneumatic, hydraulic and hydro-pneumatic

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4021340 FLUID MECHANICS AND PNEUMATICS

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topics	Hours
I	**PROPERTIES OF FLUID AND FLUID STATIC** **1.1 : Properties of fluid** Introduction –Fluid Mechanics –Definition of Fluid - Types of fluid. Properties of Fluid – Density, Specific Weight, Specific Volume, Specific gravity - Simple problem - Viscosity, Absolute Viscosity, Kinematics Viscosity, Compressibility, adhesion, Cohesion, surface tension, capillarity and Bulk Modulus. **1.2: Fluid Static** Fluid pressure at a point - Pascal's Law - Proof – Application – Hand operated Hydraulic Jack and Hydraulic Press. Pressure head-atmospheric, gauge, vacuum and absolute pressures – simple problems - Pressure measurements by piezometer tube, simple manometer, differential manometer and inverted differential manometer – problems – Mechanical pressure gauges - bourdon tube pressure gauge, diaphragm pressure gauge and Dead weight pressure gauge.	6 9
II	**FLUID DYNAMIC AND KINEMATICS, HYDRAULIC MACHINERY'S** **2.1: Fluid Dynamic and kinematics** Introduction - Types of fluid flow – steady and unsteady flow, uniform and non-uniform flow, laminar and turbulent flow, compressible and incompressible flow, rotational and irrotational flow - Reynolds number - Rate of flow-Continuity equations - energies of fluid-simple problems. Bernoulli's equations - statement, assumptions and proof – applications of Bernoulli's -pitot tube, venturimeter, and orificemeter – Simple Problems. Orifice – types of orifice – vena contracta – co-efficient of contraction – co-efficient of velocity – co-efficient discharge – simple problems. law of fluid friction - hydraulic gradient line – total energy line – wetted perimeter – hydraulic mean radius - loss of head in pipe - Major	12

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	losses – loss of head due to friction Darcy - Weisbach equation and Chezy's equation – problems- Minor losses and its types **2.2: Hydraulic Machinery's:** Pelton wheel turbine – Francis turbine – single stage centrifugal pump – double acting reciprocating pump – submergible pump.	**3**
III	**HYDRAULIC SYSTEMS AND ITS COMPONENTS:** **3.1: Hydraulic pump and actuator** Fluid Power – Application of fluid power - service properties of hydraulic fluids- Hydraulic system Elements - Pump – Positive displacement Pump- External Gear Pump, Internal Gear Pump, Vane pump, Piston pump - Hydraulic actuator - Linear actuator - Single acting cylinder – Double acting cylinder – Telescopic cylinder –Rotary actuator - Hydraulic Motor – Gear type, vane type and piston type motor. **3.2: Hydraulic valves and accessories** Directional Control valve: Types – Seat valve and spool valve – operating method – Construction of 2,3 and 4way directional control valve. Pressure control valve: Pressure relief valve Compound relief valve. Flow control valve - Unloading valve – sequence valve – counterbalance valve – brake valve – pressure reducing valve –hydraulic intensifier. Hydraulic accumulators – Reservoirs and accumulators - Types – Dead weight, spring loaded and gas loaded type. Filters – Seals and its classification – Filters and its types– Filter location.	**7** **7**
IV	**HYDRAULIC CIRCUITS AND HYDRO-PNEUMATIC** **4.1: Hydraulic Circuits** ISO Symbol of hydraulic components - Direst operation of single acting cylinder, double acting cylinder and hydraulic motor. Speed Control of hydraulic cylinder and Speed Control of hydraulic Motor– Double pump. Hydraulic circuit: sequencing circuit – counterbalancing circuit – Regeneration circuit - Braking circuit – Intensifier circuit – Accumulator circuit – synchronizing circuit - Two hand safety circuit - Fail-safe control circuit by using emergency cut-off valve.	**11**

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	Hydraulic circuit for operation of shaper machine, vertical milling machine and surface grinder **4.2: Hydro-pneumatic** Types – Air-oil reservoir, Air-oil cylinder, air-oil intensifier –Comparison of pneumatic, hydraulic and hydro-pneumatic.	**3**
V	**PNEUMATIC SYSTEMS, COMPONENTS AND PNEUMATIC CIRCUITS** **5.1: Pneumatic Systems, components** Pneumatic Systems –elements - Compressor – Piston type and Vane type compressor – filter – regulator - lubricator unit – mufflers. Pneumatic actuator – Single acting cylinder – Double acting cylinder – Air motors – Vane type and piston type. Pneumatic valves – Directional control valves - 2/2, 3/2, 4/2, 4/3 & 5/2 - Control methods - Pressure relief valves - Check Valve - Flow control Valve - shuttle valve – Twin pressure valve - Quick exhaust valve - Time delay valve. **5.2: Pneumatic circuits** ISO Symbol Pneumatic components - Controlling of single acting and Double acting cylinder - Speed control circuit, Quick exhaust valve circuit, Two step feed control circuit, Time delay circuit, Automatic cylinder reciprocating circuit, Deceleration air cushion of cylinder circuit - two hand safety control circuit.	**8** **7**

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Reference Books

1. A Text Book of Hydraulics, Fluid Mechanics and Hydraulic Machines, R.S. Khurmi, S.Chand& Co.
2. A Text Book of Hydraulics, Fluid Mechanics and Hydraulic Machines, Dr.R.K.Bansal Laxmi Publication Pvt., Ltd.
3. Hydraulic Machines, Jagadishlal, Metropolitan Book Co. Pvt. Ltd.
4. Fluid Power, Anthony Esposito, Pearson Education.
5. Pneumatic System – Principles and Maintenance, S.R.Majumdar, McGraw Hill Education.

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6. Oil Hydraulic System – Principles and Maintenance, S.R.Majumdar, McGraw Hill Education.
7. Fundamentals of pneumatic control Engineering -FESTO Manual

Reference Web Link / Video

Topic	Website	Link
Fluid Mechanics	NPTEL	https://nptel.ac.in/courses/112/104/112104118/
Fluid Mechanics and Fluid Power	Dote E-Lecture	https://www.youtube.com/watch?v=xmkh7M9R7nM&list=PL1b9Ht9ISqIHpYIanUmZMrVUnF_CABwRk
Oil Hydraulics and Pneumatics	NPTEL	https://nptel.ac.in/courses/112/106/112106300/

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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 : 1021 Diploma in Automobile Engineering

Subject Code : 4021350

Semester : III

Subject Title : Material Testing and Fluid Mechanics & Pneumatics 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	
4021350 Material Testing and Fluid Mechanics & Pneumatics Practical	4	64	25	100*	100	3 Hrs.

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

RATIONALE:

This subject deals with the testing and behavior of metals at various testing condition and to create better understanding of the behavior of fluids under the condition of rest and motion. This subject deals with hydraulic and pneumatic operation.

OBJECTIVES:

At the end of the course, the students will be able to,

- 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 coil springs.
- Determine the co-efficient of discharge of venturimeter.
- Determine the co-efficient of friction in pipes.
- Design and operate pneumatic circuit and hydraulic circuit.

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4021350 MATERIAL TESTING AND FLUID MECHANICS & PNEUMATICS PRACTICAL

DETAILED SYLLABUS

Experiments

PART A

1. Tension test on Ductile Materials- Finding Young's Modulus of Elasticity, Yield Points, Percentage Elongation and Percentage Reduction in Area, Stress Strain Diagram Plotting test on Mild Steel with the help of a Universal Testing machine.
2. Torsion test - Torsion test on mild steel – relation between torque and angle of twist determination of shear modulus and shear stress. Draw a graph between torque and angle of twist in radians.
3. Test on spring - Compression Tests on open coil spring - Determination of modulus of rigidity, strain energy, shear stress and stiffness by load deflection method. Draw a graph between load and deflection
4. Test on orifice - Determination of co-efficient of discharge of a orifice by variable head method and a graph between $\sqrt{H_1} - \sqrt{H_2}$ Vs time taken (t).
5. Test on venturimeter - Determination of co-efficient of discharge of the venturimeter and draw the following graphs between (i) head Loss (h_f) Vs Actual discharge (Q_a) and (ii) head loss (h_f) Vs co-efficient of discharge (C_d)
6. Test on pipe friction apparatus - Determine the friction factor of the given pipe and draw a graph between friction head (h_f) and Velocity (v).

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PART B

Pneumatics Lab.

1. Direct operation of pilot control of single acting cylinder and double acting cylinder.
2. Speed control of double acting cylinder using metering-in and metering-out circuits.
3. Automatic operation of double acting cylinder in single cycle – using limit switch.

Hydraulics Lab.

4. Direct operation of double acting cylinder
5. Direct operation of hydraulic motor.
6. Speed control of double acting cylinder metering-in and metering-out control.

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BOARD EXAMINATION

Note:

- All the exercises / experiments in both sections should be completed. Two exercises / experiments will be given for examination by selecting one from PART A and one from PART B.
- All the exercises / experiments should be given in the question paper and students are allowed to select by 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 / equipment before commencement of the board practical examination.

DETAILLED ALLOCATION OF MARKS

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Sl. No.	Description	Max. Marks
	Part- A	
1	Observation	10
2	Tabulation and Calculation	40
3	Result and Graph	5
	Part- B	
4	Circuit	10
5	Connection as per circuit	20
6	Execution of circuit	5
7	**Viva-voce**	10
	Total	100

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LIST OF EQUIPMENT / TOOLS / MACHINERY REQUIRED

(for a batch of 30 students)

Sl. No.	Machinery's / Equipment / Tools	Quantity
1.	Universal Testing Machine (UTM)	01
2.	Torsion testing machine	01
3.	Spring testing machine	01
4.	Pipe friction Apparatus	01
5.	Venturimeter Apparatus	01
6.	Orifice testing kit setup	01
7.	Pneumatics Trainer Kit with all standard accessories	02
8.	Hydraulics Trainer Kit with all standard accessories	02
9.	Measuring instruments	Sufficient quantity
10.	Consumables	Sufficient quantity

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Reference Web Link / Video

Topic	Website	Link
Strength of Materials Practical	Virtual Labs	https://sm-nitk.vlabs.ac.in/
Fluid Mechanics Practical	Virtual Labs	https://fm-nitk.vlabs.ac.in/
Fluid Mechanics Practical	Virtual Labs	https://fmc-nitk.vlabs.ac.in/
Pneumatic Components	Virtual Labs	http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/COEP_KNOWLEDGE_SEEKERS/labs/exp1/index.html

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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 : 1021 Diploma in Automobile Engineering
Subject Code : 4021360
Semester : III
Subject Title : Production Technology 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	
4021360 Production Technology 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.

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RATIONALE:

In the process of manufacturing we should possess adequate and through knowledge about the working of metal forming as well as metal cutting processes. The topics included aim to inculcate the skills of metal cutting, milling, grinding, and other machining processes which are very much essential for a technician. This will provide the students an opportunity to skill themselves for the industrial scenario.

OBJECTIVES:

Students must be able to:

- 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 parts of drilling machine.
- Perform the various drilling operations.

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- Identify the parts of a lathe.
- Operate the lathe and machine a component using lathe.
- Study the working of various machine tools: Shaper.
- Study various types of milling operations.
- Perform the milling procedure for spur gear
- Study the different types of grinders and grinding wheels.

4021360 PRODUCTION TECHNOLOGY PRACTICAL

DETAILED SYLLABUS

EXERCISES

PART-A

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 specimen and make the T-joint by the Arc Welding (Both sidewelded). (Raw material 25mmX6mm MS flat)
4. Prepare the specimen and make the Butt joint by the Gas Welding. (Raw material 25mmX3mm MS sheet)
5. Prepare the specimen and make the drilling and counter boring as shown in figure using the upright drilling machine / Radial drilling machine.

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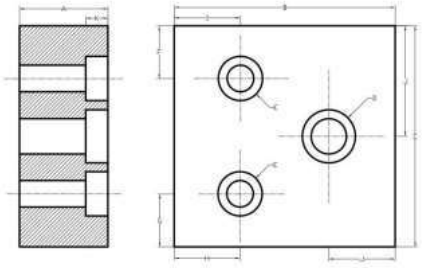

Dimensions			
Sl.No	Part Name	Actual	Obtained

6. Prepare the specimen and make the plain surfaces as shown in figure using the surface Grinder.

Dimensions			
Sl.No	Part Name	Actual	Obtained

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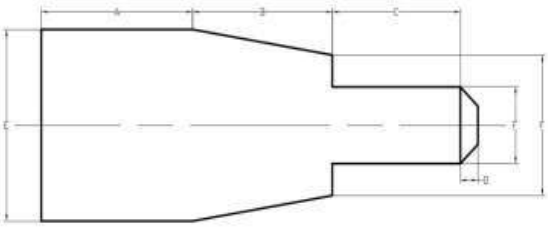
PART – B

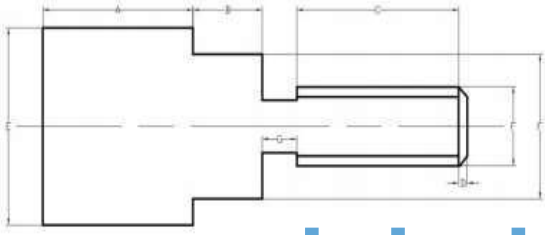
Exercise

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



Dimensions			
Sl.No	Part Name	Actual	Obtained

2. Prepare the specimen and make the Step Turing & Thread cutting as shown in figure using the Lathe.



Dimensions			
Sl.No	Part Name	Actual	Obtained

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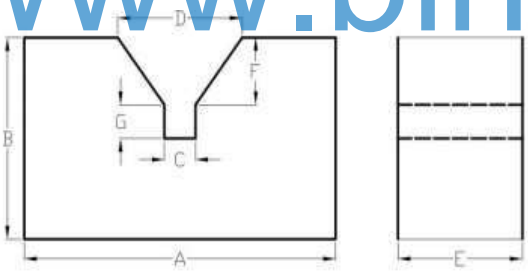
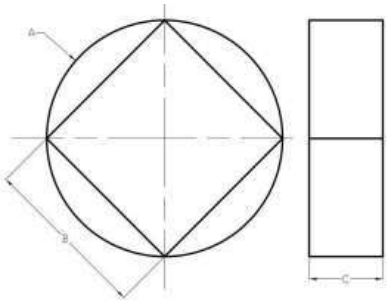
3. Prepare the specimen and make 'V' Block as shown in figure using Shaping machine



Dimensions			
Sl.No	Part Name	Actual	Obtained

4. Prepare the specimen and make round to square as shown in figure using milling machine



Dimensions			
Sl.No	Part Name	Actual	Obtained

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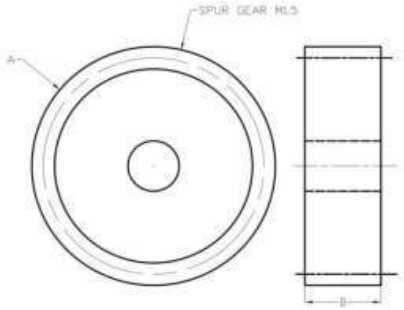
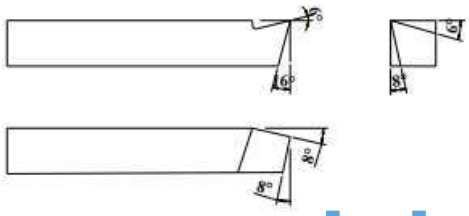
5. Prepare the specimen and make Spur Gear as shown in figure using milling machine by indexing method.



Dimensions			
Sl.No	Part Name	Actual	Obtained

6. Prepare the specimen and make the turning tool as shown in figure using the Tool and Cutter Grinder.



Dimensions			
Sl.No	Part Name	Actual	Obtained

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BOARD EXAMINATION

Note:

- All the exercises/experiments in both sections should be completed. Two exercises/experiments will be given for examination by selecting one from PART A and one from PART B.
- All the exercises/experiments 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 machineries / equipments before commencement of the board practical examination.

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DETAILLED ALLOCATION OF MARKS

Sl. No.	Description	Max. Marks
	Part- A	
1	Procedure / Preparation	10
2	Machining / Dimensions	25
3	Finishing	5
	Part- B	
4	Procedure / Preparation	10
5	Machining / Dimensions	35
6	Finishing	5
7	**Viva-voce**	10
	Total	100

LIST OF EQUIPMENT / TOOLS / MACHINE REQUIRED

(for a batch of 30 students)

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Sl. No.	Machines /Tools/ Equipments	Quantity
1	Moulding board	5 Nos.
2	Cope box	5 Nos.
3	Drag box	5 Nos.
4	Core box	5 Nos.
5	Shovel	2 Nos.
6	Rammer set	5 Nos.
7	Slick	5 Nos.
8	Strike-off bar	5 Nos.
9	Riddle	2 Nos.
10	Trowel	5Nos.
11	Lifter	5 Nos.
12	Cleaning Brush	5 Nos.
13	Vent rod	5 Nos.
14	Draw spike	5 Nos.
15	Gate cutter	5 Nos.
16	Runner & riser	5 Nos. each
17	Arc welding transformer	1 No
18	Gas welding unit	1 Set
19	Welding shield	5 Nos.

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20	Gas welding goggles	5 Nos.
21	Chipping hammer	10 Nos.
22	Leather Glows 18''	10 Sets.
23	Upright drilling machine / Radial drilling machine	1 No.
24	Vernier Height Gauge	1 No.
25	Surface plate	1 No.
26	Lathe	4 Nos.
27	Vertical milling machine	1 No.
28	Universal Milling Machine	1 No.
29	Surface Grinding Machine	1 No.
30	Tool and Cutter Grinder	1 No.
31	Shaping Machine	1 No.
32	Tools and Measuring instruments	Sufficient quantity
33	Personal protective equipment	Sufficient quantity
34	Fire safety equipment	Sufficient quantity
35	Consumable	Sufficient quantity

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Reference Book

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017

Reference Web Link / Video

Topic	Website	Link
Manufacturing Processes	Virtual Lab	http://vlabs.iitkgp.ac.in/psac/newlabs2020/vlabiitkgpAM/#

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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 : 1021 Diploma in Automobile 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.

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* 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.

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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.

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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**

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LIST OF EQUIPMENTS (For 30 students)

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

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