

# STATE BOARD OF TECHNICAL EDUCATION, BIHAR

## Scheme of Teaching and Examinations for V SEMESTER DIPLOMA IN MECHANICAL ENGG.

( Effective from Session 2016-17 Batch )

### THEORY

Sr. No.	SUBJECT	SUBJECT CODE	TEACHING SCHEME	EXAMINATION-SCHEME							
			Periods per Week	Hours of Exam.	Teacher's Assessment (TA) Marks A	Class Test (CT) Marks B	End Semester Exam.(ESE) Marks C	Total Marks (A+B+C)	Pass Marks ESE	Pass Marks in the Subject	Credits
1.	Advanced Manufacturing Processes	1625501	03	03	10	20	70	100	28	40	03
2.	Power Engineering	1625502	03	03	10	20	70	100	28	40	03
3.	Environmental Pollution & Control	1625503	03	03	10	20	70	100	28	40	03
4.	Metrology & quality Control	1625504	03	03	10	20	70	100	28	40	03
5.	Automobile Engineering	1625505	03	03	10	20	70	100	28	40	03
<b>Total :-</b>			<b>15</b>				<b>350</b>	<b>500</b>			

### PRACTICAL

Sr. No.	SUBJECT	SUBJECT CODE	TEACHING SCHEME	EXAMINATION-SCHEME					
			Periods per Week	Hours of Exam.	Practical (ESE)		Total Marks (A+B)	Pass Marks in the Subject	Credits
					Internal(A)	External(B)			
6.	Metrology & quality Control Lab	1625506	04	03	15	35	50	20	02
7.	Advanced Manufacturing Processes Lab	1625507	04	06	15	35	50	20	02
<b>Total :-</b>			<b>08</b>				<b>100</b>		

### TERM WORK

Sr. No.	SUBJECT	SUBJECT CODE	TEACHING SCHEME	EXAMINATION-SCHEME					
			Periods per Week	Marks of Internal Examiner (X)	Marks of External Examiner (Y)	Total Marks (X+Y)	Pass Marks in the Subject	Credits	
8.	Industrial Project & Entrepreneurship Development (TW)	1625508	03	15	35	50	20	02	
9.	Professional Practices-V (TW)	1625509	04	15	35	50	20	02	
10.	Metrology & quality Control (TW)	1625510	03	15	35	50	20	01	
<b>Total :-</b>			<b>10</b>			<b>150</b>			
<b>Total Periods per week Each of duration One Hour</b>						<b>33</b>	<b>Total Marks = 750</b>		<b>24</b>

**ADVANCED MANUFACTURING PROCESSES**  
**(MECHANICAL ENGINEERING GROUP)**

<b>Subject Code</b> <b>1625501</b>	<b>Theory</b>					<b>Credits</b>  <b>03</b>	
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>		<b>100</b>
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>ESE</b>	<b>:</b>		<b>70</b>
	<b>03</b>	<b>—</b>	<b>—</b>	<b>TA</b>	<b>:</b>		<b>10</b>
	<b>—</b>	<b>—</b>	<b>—</b>	<b>CT</b>	<b>:</b>		<b>20</b>

**CONTENTS : THEORY**

<b>Chapter</b>	<b>Name of the Topic</b>	<b>Hours</b>	<b>Marks</b>
<b>Unit-01</b>	<b>Non traditional machining processes :</b>		
	<b>1.1 Electrical discharge Machining.</b> Principle of working, Setup of EDM, Dielectric fluid, tools (electrodes), Process parameters, Output characteristics, Applications e.g. microhole drilling, curve hole drilling.	<b>05</b>	<b>08</b>
	<b>1.2 Wire cut EDM -</b> Principle of working, Setup of WEDM, controlling Parameters, Applications.	<b>03</b>	<b>04</b>
	<b>1.3 Laser Beam Machining.</b> Physical principle of Laser, Laser action in ruby rod, Types of Lasers. Set-up for LBM. Characteristics, controlling Parameters, Applications, Application Of Laser Beam for Welding (LBW)	<b>05</b>	<b>08</b>
	<b>1.4 Other non traditional machines such as ECM</b> Principle of working, Applications.	<b>03</b>	<b>04</b>
<b>Unit-02</b>	<b>CNC milling machines :</b> Vertical and horizontal machining center: Constructional features, Axis identification, Electronic control system. Automatic tool changer and tool magazine. CNC programming: Preparatory functions (G code), miscellaneous functions (M code), Part programming including subroutines and canned cycles. Principles of computer aided part programming.	<b>12</b>	<b>16</b>
<b>Unit-03</b>	<b>Machine Tool Automation: Introduction and Need :</b> (A) Single spindle automates, transfer lines.	<b>05</b>	<b>08</b>
	(B) Elements of control system, Limit switches, Proximity switches, Block diagram for feedback and servo control system, Introduction to PLC, Block diagram of PLC.	<b>07</b>	<b>08</b>
<b>Unit-04</b>	<b>Special Purpose Machines (SPM) :</b> Concept, General elements of SPM, Productivity improvement by SPM, Principles of SPM design.	<b>03</b>	<b>06</b>
<b>Unit-05</b>	<b>Maintenance of Machine Tools :</b> Types of maintenance, Repair cycle analysis, Repair complexity, Maintenance manual, Maintenance records, Housekeeping. Introduction to Total Productive Maintenance (TPM).	<b>05</b>	<b>08</b>
	<b>Total</b>	<b>48</b>	<b>70</b>

<b>Text /Reference Books:</b>		
<b>Titles of the Book</b>	<b>Name of Authors</b>	<b>Name of the Publisher</b>
Manufacturing Science	Amitabh Ghosh , Mallik	East-West Press Pvt. Ltd.
Production Technology	HMT, Bangalore	Tata Mc-Graw Hill
CNC machines	Pabla B. S. M. Adithan	New Age international limited.
Industrial maintenance	H.P.Garg	S. Chand & Co. Ltd.
Non conventional Machining	P. K. Mistra	Narvasa Publishining House
Maintenance Engg. Handbook	Lindley R. Higgins	Mc-Graw Hill
Manufacturing Processes	Begman, Amsted	John Willey and Sons.
Fundamental of metal cutting and machine tools	B. L. Juneja	New age international limited.
Technology of Machine Tools.	Steve Krar, Albert Check	Mc-Graw-Hill International.
CAD/CAM Principals and Applications	P. N. Rao	Tata McGrow-Hill
Manufacrutng Technology Metal Cutting & Machne tools	P. N. Rao	Tata McGrow-Hill
Advanced Manufacturing Processes	R.M. Pandey, S.K. Goyal	Foundation Publishing

**POWER ENGINEERING**  
**(MECHANICAL ENGINEERING GROUP)**

<b>Subject Code 1625502</b>	<b>Theory</b>					<b>Credits  03</b>	
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>		<b>100</b>
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>ESE</b>	<b>:</b>		<b>70</b>
	<b>03</b>	<b>—</b>	<b>—</b>	<b>TA</b>	<b>:</b>		<b>10</b>
	<b>—</b>	<b>—</b>	<b>—</b>	<b>CT</b>	<b>:</b>		<b>20</b>

**CONTENTS : THEORY**

<b>Chapter</b>	<b>Name of the Topic</b>	<b>Hours</b>	<b>Marks</b>
<b>Unit-01</b>	<b>I.C. Engine :</b> 1.1 Power Cycles - Carnot, Otto, Diesel, Dual, Brayton Cycle, representation on P-V, T-S diagram and Simple numerical on Otto cycle only. 1.2 Classification of I.C. Engines 1.3 Two stroke and four stroke Engines Construction and working, comparison, valve timing Diagram. 1.4 Brief description of I.C. Engine combustion (SI & CI), scavenging, preignition, detonation, supercharging, turbo charging, simple Carburetor, M.P.F.I., fuel injection pump. 1.5 List of fuel, lubricant additives and their advantages.	<b>14</b>	<b>18</b>
<b>Unit-02</b>	<b>I.C. Engine Testing and Pollution Control :</b> 2.1 Engine Testing - I.P., B.P. Mechanical, Thermal relative and volumetric efficiency, BSFC, Heat Balance sheet. 2.2 Morse Test, Motoring test 2.3 Pollution Control - Pollutants in exhaust gases of petrol and diesel engines, their effects on environment, exhaust gas analysis for petrol and diesel engine, Catalytic Converter, Bharat stage I, II, III norms.	<b>12</b>	<b>14</b>
<b>Unit-03</b>	<b>. AIR COMPRESSER :</b> 3.1 Introduction 3.2 uses of compressed air - Classification of air compressors - Definition: - Compression ratio - Compressor capacity - Free Air Delivered - Swept volume 3.3 Reciprocating air compressor - Construction and working of single stage and two stage compressor - Efficiency: - Volumetric , Isothermal & Mechanical ( only simple numerical) - Advantages of multi staging. 3.4 Rotary Compressor - Construction and working of screw, lobe, vane, centrifugal compressors (No numerical) - Comparison and applications of reciprocating and rotary compressors - Purification of air to remove oil, moisture and dust 3.5 Methods of energy saving in air compressors	<b>12</b>	<b>14</b>

<b>Unit-04</b>	<p><b>Gas Turbine And Jet Propulsion :</b></p> <p>4.1 Classification and applications of gas turbine.</p> <p>4.2 Constant volume and constant pressure gas turbines. - Closed cycle and open cycle gas turbines and their comparison.</p> <p>4.3 Methods to improve thermal efficiency of gas turbine- Regeneration, inter- cooling, reheating using T- <math>\phi</math> diagram (no analytical treatment).</p> <p>4.4 Jet Propulsion - Principles of turbojet, turbo propeller, Ram jet.</p> <p>4.5 Rocket propulsion - Solid propellants and liquid propellants, components of liquid propellants rocket engine.</p>	<b>12</b>	<b>10</b>
<b>Unit-05</b>	<p><b>Refrigeration and Air- Conditioning :</b></p> <p>5.1 Introduction - COP of Heat Pump and refrigerator, Tonnes of Refrigeration.</p> <p>5.2 Vapour compression system - Vapour compression refrigeration cycle, components of Vapour Compression Cycle. Applications- Water cooler Domestic refrigerator, Ice plant &amp; cold storage.</p> <p>5.3 Psychrometry - Properties of air, psychrometric chart &amp; processes (No Numerical)</p> <p>5.4 Air conditioning systems - Definition of Air conditioning and classification of Air conditioning Systems.</p>	<b>14</b>	<b>14</b>
<b>Total</b>		<b>64</b>	<b>70</b>

<b>Text / Reference Books:</b>		
<b>Titles of the Book</b>	<b>Name of Authors</b>	<b>Name of the Publisher</b>
Course in Thermal Engineering	V. M. Domkundwar	Dhanpat Rai & Co
Thermal Engineering	P.L.Ballaney	Khanna Publishers
Text Book of Thermal Engineering	R.S.Khurmi	S.Chand & Co. Ltd
Heat Engine Vol.-I and Vol.-II	Patel. Karamchandani	Acharya Publication
Automobile Engineering	R. k. Jain	Tata McGraw Hill
Industrial power engg.& application handbook	K.C.Agrawal	
Power Engineering	Bishwajeet Ranjan, Rajesh Verma	Foundation Publishing

**ENVIRONMENTAL POLLUTION & CONTROL**  
**(MECHANICAL ENGINEERING GROUP)**

<b>Subject Code 1625503</b>	<b>Theory</b>						<b>Credits</b>
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>	<b>100</b>	<b>03</b>
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>ESE</b>	<b>:</b>	<b>70</b>	
	<b>03</b>	—	—	<b>TA</b>	<b>:</b>	<b>10</b>	
—	—	—	<b>CT</b>	<b>:</b>	<b>20</b>		

**CONTENTS: THEORY**

	<b>Name of the Topic</b>	<b>Hrs/week</b>	<b>Marks</b>
<b>Unit -1</b>	<b>Introduction</b> 5.5 Environment 5.6 Ecosystem 5.7 Classification of pollution & pollutants 5.8 Environment & pollution control acts 5.9 ISO 14000 standards, 5.10 Kyoto treaty / protocol, carbon units.	<b>04</b>	<b>06</b>
<b>Unit -2</b>	<b>Air Pollution</b> <b>Part A</b> <ul style="list-style-type: none"> <li>• Sources &amp; classification of air pollution</li> <li>• Effects of air pollution on human health</li> <li>• Effects of air pollution on economy</li> <li>• Photochemical air pollution</li> </ul> Air pollution from major Industrial operations e.g. Fertilizer industries aluminum manufacturing plants, Acid plants, Cement industries, Coal & tar industries, paper industries, Refinery & petrochemical industries	<b>10</b>	<b>14</b>
	<b>Part B</b> Air pollution due to Automobiles-design and operating parameters and methods of control <ul style="list-style-type: none"> <li>• Pollution due to S. I. Engines. Design &amp; operating parameters responsible for emission and methods of pollution control.</li> <li>• Pollution due to C. I. Engines. Design &amp; operating parameters responsible for emission and methods of pollution control.</li> <li>• Air quality &amp; emission standards of India &amp; Europe</li> <li>• Air pollution in Indian metro cities- Delhi, Mumbai, Chennai, Kolkata</li> </ul>	<b>14</b>	<b>18</b>
<b>Unit - 3</b>	<b>Water Pollution</b> <ul style="list-style-type: none"> <li>• Sources of water pollution.</li> <li>• Effects of water pollution.</li> <li>• Water pollution analysis                             <ul style="list-style-type: none"> <li>• Physical examination of water</li> <li>• Chemical characteristics of water</li> <li>• Biological investigation of water</li> </ul> </li> <li>• Definitions of Important terms used in water pollution – Dissolved O<sub>2</sub>, Chemical O<sub>2</sub> demand, Biological O<sub>2</sub> demand, Theoretical O<sub>2</sub> demand, Total solids, Total suspended solids, Total dissolved solids, Turbidity, Alkalinity, Acidity.</li> <li>• Water quality standards</li> <li>• Steps in Water treatment</li> <li>• Sampling &amp; analysis of water pollution</li> </ul>	<b>06</b>	<b>10</b>

<b>Unit – 4</b>	<b>Noise Pollution</b> <ul style="list-style-type: none"> <li>• Definition of noise</li> <li>• Sources of noise</li> <li>• Types of noise – Impulsive &amp; sonic noise</li> <li>• Effects of noise on health</li> <li>• Noise measurement</li> <li>• Noise mapping</li> </ul>	<b>04</b>	<b>08</b>
<b>Unit – 5</b>	<b>Other Types Of Pollution</b> <ul style="list-style-type: none"> <li>• Solid waste <ul style="list-style-type: none"> <li>• Classification of solids</li> <li>• Solid waste management</li> <li>• Method of solid waste disposal</li> <li>• Reuse, Recycling &amp; recovery of materials from refuse</li> </ul> </li> <li>• Soil pollution <ul style="list-style-type: none"> <li>• Chemistry of soil</li> <li>• Soil irrigation by effluents</li> <li>• Agricultural pollution</li> </ul> </li> <li>• Radiation pollution <ul style="list-style-type: none"> <li>• Sources &amp; effects of radiation</li> <li>• Radiation exposure standards</li> <li>• Radiation protection</li> </ul> </li> <li>5.3.4 Treatment &amp; disposal of radiation waste</li> <li>• Global pollution <ul style="list-style-type: none"> <li>• Green house effect</li> <li>• Acid rain</li> <li>• Ozone depletion problem</li> </ul> </li> </ul>	<b>10</b>	<b>14</b>
<b>Total</b>		<b>48</b>	<b>70</b>

**Text/ Reference Books:-**

<b>Titles of the Book</b>	<b>Name of Authors</b>	<b>Name of the Publisher</b>
Air pollution	M.N. Rao & H.V.N. Rao	Tata McGraw Hill
Automotive Mechanics	William H. Course & Donald L. Anglin	Tata McGraw Hill
Internal Combustion Engines	K.K. Ramlingam	Scitech
Water Supply and Sanitary Engineering	G.S. Bilgi	Dhanpat Rai and Sons.
Elements of Environment Science & Engineering	P. Meenakshi	Prentice-Hall
A basic course in environmental studies	S.Deswal & A. Deswal	Dhanpat Rai and Sons.
Introduction to Environmental Engineering.	P. Aarne Vesilind & Susan M. Morgan	Thomson
Environmental Pollution Control Engineering	C.S Rao	
Environmental pollution control microbiology	McKinney	

**METROLOGY & QUALITY CONTROL**  
**(MECHANICAL ENGINEERING GROUP)**

<b>Subject Code 1625504</b>	<b>Theory</b>						<b>Credits  03</b>	
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>		<b>:</b>		<b>100</b>
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>ESE</b>		<b>:</b>		<b>70</b>
	<b>03</b>	<b>—</b>	<b>—</b>	<b>TA</b>		<b>:</b>		<b>10</b>
	<b>—</b>	<b>—</b>	<b>—</b>	<b>CT</b>		<b>:</b>		<b>20</b>

**CONTENTS : THEORY**

<b>Chapter</b>	<b>Name of the Topic</b>	<b>Hours</b>	<b>Marks</b>
<b>Unit-01</b>	<b>Introduction to metrology :</b> <b>1.1 Metrology Basics</b> Definition of metrology, Categories of metrology, Scientific metrology, Industrial metrology, Legal metrology, Need of inspection, <b>Revision of ( no questions be set) -</b>	<b>03</b>	<b>04</b>
	<b>1.2 Standards and Comparators</b> Definition and introduction to line standard, end standard, Wavelength standard, Slip gauge and its accessories, Length bars. Definition, Requirement of good comparator, Classification, use of comparators, Working principle of comparators, Dial indicator, Sigma comparator, Pneumatic comparator, Electrical, Electronic, Relative advantages and disadvantages.	<b>06</b>	<b>08</b>
	<b>1.3 Limits, Fits ,Tolerances and Gauges</b> Concept of Limits, Fits, And Tolerances, Selective Assembly, Interchangeability, Hole And Shaft Basis System, Taylor's Principle, Design of Plug, Ring Gauges, IS919-1993 (Limits, Fits & Tolerances, Gauges IS 3477-1973, concept of multi gauging and inspection.	<b>05</b>	<b>06</b>
	<b>1.4 Angular Measurement</b> Concept, Instruments For Angular, Measurements, Working And Use of Universal Bevel Protractor, Sine Bar, Spirit Level, Principle of Working of Clinometers, Angle Gauges (With Numerical on Setting of Angle Gauges).	<b>05</b>	<b>06</b>
<b>Unit-02</b>	<b>Threads and Gear Metrology :</b> <b>2.1 Screw thread Measurements</b> ISO grade and fits of thread, Errors in threads, Pitch errors, Measurement of different elements such as major diameter, minor diameter, effective diameter, pitch , Two wire method, Thread gauge micrometer, Working principle of floating carriage dial micrometer.	<b>03</b>	<b>03</b>
	<b>2.2 Gear Measurement and Testing</b> Analytical and functional inspection, Rolling test, Measurement of tooth thickness (constant chord method), gear tooth vernier, Errors in gears such as backlash, run out, composite.	<b>03</b>	<b>03</b>



<b>Unit-03</b>	<b>Testing Techniques :</b> <b>3.1 Measurement of surface finish</b> Primary and secondary texture, Sampling length, Lay, terminology as per IS 3073- 1967, direction of lay, Sources of lay and its significance, CLA, Ra, RMS, Rz values and their interpretation, Symbol for designating surface finish on drawing, Various techniques of qualitative analysis, Working principle of stylus probe type instruments.	<b>03</b>	<b>04</b>
	<b>3.2 Machine tool testing</b> Parallelism, Straightness, Squareness, Coaxiality, roundness, run out, alignment testing of machine tools as per IS standard procedure.	<b>06</b>	<b>06</b>
<b>Unit-04</b>	<b>Quality Control :</b> <b>A) Quality :</b> Definitions, meaning of quality of product & services, Quality characteristics, Quality of design, Quality of conformance, Quality of performance, Concept of reliability, Cost, Quantity assurance, Cost of rework & repair, Quality & Inspection, Inspection stages.	<b>04</b>	<b>04</b>
	<b>B) Total Quality Management :</b> 1) Principles of total quantity management. i) Customer focus. ii) Commitment by top management. iii) Continuous improvement–PDCA, Quality Circles. iv) Employee empowerment (JIDOKA). 2) Quality Audit: Concept of audit practices, lead assessor certification. 3) Six sigma: Statistical meaning, methodology of system Improvement , DMAIC cycle, Yellow belt, Green belt, Black belt certification.	<b>06</b>	<b>06</b>
	<b>C) ISO 9000 Series &amp; other standards :</b> Concept, ISO 9000 series quality standards, QS14000, Standards in general, Its evaluation & Implications, necessity of ISO certification, other Quality systems.	<b>04</b>	<b>04</b>
<b>Unit-05</b>	<b>Elementry Statistics &amp; it's application in quality control :</b> <b>5.1 Statistical Quality Control</b> – Meaning and importance of SQC, Variable and attribute Measurement. control charts – inherent and assignable sources of variation, control charts for variables – X & R charts, control charts for attributes p, np, C charts, process capability of machine, determination of statistical limits, different possibilities, Rejection area, Statistically capable and incapable processes, Cp, Cpk.	<b>10</b>	<b>10</b>
	<b>5.2 Acceptance Sampling</b> – Concept, Comparison with 100% inspection, Different types of sampling plans, with merits and demerits, OC curve, It's importance and significance, Producers risk, Consumer's risk, AQL, AOQL, IQL, LTPD	<b>08</b>	<b>08</b>
	<b>Total</b>	<b>64</b>	<b>70</b>

<b>Text / Reference Books:-</b>		
<b>Titles of the Book</b>	<b>Name of Authors</b>	<b>Name of the Publisher</b>
Engineering metrology	R. K. Jain	Khanna Publisher, Delhi.
Metrology for Engineers	J.F.W. Galyer and C. R. Shotbolt	ELBS
Engineering Metrology	K. J. Hume	Kalyani publishers
A text book of Engineering metrology	I.C. Gupta	Dhanpat Rai and Sons,
Metrology Lab. Manual	M. Adithan and R. Bahn	T.T.T.I. Chandigarh.
Statistical Quality Control	M. Mahajan	Dhanpat Rai and Sons ,
Quality control	T.T.T.I. Chennai	Tata McGraw Hill,
Quality planning and analysis	Juran U.M. and Gryna	Tata McGraw Hill,
Inspection and quality control	National productivity council	N.P.C., New Delhi.
Managing for Total Quality	N. Logothetis	Prentice - Hall, Delhi.
Statistical Process analysis	Lauth Alwan	Tata McGraw Hill.
Metrology & Quality Control	S.P. Singhal	Foundation Publishing
Metrology & Precision	A.J.T. Scarr	Tata McGraw hill

## **2. IS/ International Codes :**

IS 919 – 1993 Recommendation for limits, fits and tolerances  
 IS 2029 – 1962 Dial gauges.  
 IS 2103 – 1972 Engineering Square  
 IS 2909 – 1964 Guide for selection of fits.  
 IS 2921 – 1964 Vernier height gauges  
 IS 2949 – 1964 V Block.  
 IS 2984 – 1966 Slip gauges.  
 IS 3139 – 1966 Dimensions for screw threads. IS 3179 – 1965 Feeler gauges.  
 IS 3455 – 1966 Tolerances for plain limit gauges.  
 IS 3477 – 1973 Snap gauges.  
 IS 6137 – 1971 Plain plug gauges. IS 3651 – 1976 - Vernier Caliper  
 IS 4218 - Isometric screw threads  
 IS 4440 – 1967 Slip gauges accessories  
 IS 5359 – 1969 Sine bars  
 IS 5402 – 1970 Principle and applications of sine bars  
 IS 5939 – 1970 Sine angles, sine tables.

**AUTOMOBILE ENGINEERING**  
**(MECH. ENGG. GROUP)**

<b>Subject Code</b> <b>1625505</b>	<b>Theory</b>					<b>Credits</b>  <b>03</b>	
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>		<b>100</b>
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>ESE</b>	<b>:</b>		<b>70</b>
	<b>03</b>	<b>—</b>	<b>—</b>	<b>TA</b>	<b>:</b>		<b>10</b>
	<b>—</b>	<b>—</b>	<b>—</b>	<b>CT</b>	<b>:</b>	<b>20</b>	

<b>Contents : Theory</b>			<b>Hrs/week</b>	
<b>Chapter</b>	<b>Name of the Topic</b>	<b>Hours</b>	<b>Marks</b>	
<b>Unit-01</b>	<b>Introduction of Automobile</b> 1.1 Classification of automobiles 1.2 Vehicle layout & types 1.3 Body construction - Types & Nomenclature of car body. Introduction to aerodynamic body shapes 1.4 Automobile market in India of “on road vehicles”, major manufacturers, their products & their collaborations.	<b>06</b>	<b>08</b>	
<b>Unit-02</b>	<b>Automobile Transmission</b> 2.1 Clutch- necessity, construction & working of coil spring & diaphragm spring type clutch. 2.2 Gear Box- tractive effort and tractive resistance, types of G.B construction & working of constant mesh G.B., & synchromesh G.B., Epicyclic G.B., Torque converter, Overdrive, Transfer case 2.3 Final drive- necessity, construction & working of propeller shaft & differential. 2.4 Axle- Type of rear axles, front axles & their applications.	<b>12</b>	<b>18</b>	
<b>Unit-03</b>	<b>Control Systems</b> 3.1 Steering system- Requirement of steering system. Construction and working of steering linkage. Steering gear box- construction & working of rack and pinion & re-circulating ball type gearbox. Introduction to Power steering, Steering geometry- camber, caster, toe-in, toe-out, Kingpin inclination & their effects. 3.2 Brake system- construction & working of hydraulic & Pneumatic brakes. Comparison of disc & drum brake.	<b>08</b>	<b>14</b>	
<b>Unit-04</b>	<b>Suspension systems, wheels &amp; Tyres</b> 4.1 Necessity & classification of suspension system. 4.2 Working & construction of Leaf spring, rigid axle suspension. 4.3 Introduction to air suspension 4.4 Construction & working of McPherson & wishbone, trailing link suspensions. 4.5 Construction & working of telescopic shock absorbers. 4.6 Construction & working of spoked wheel, disc wheel & light alloy cast wheel. 4.7 Types of rims, their construction & working. 4.8 Construction, working & comparison of radial, cross-ply and tubed, tubeless tyre & tyre specifications 4.9 Factors affecting tyre life 4.10 Wheel Alignment and Balancing	<b>08</b>	<b>12</b>	

<b>Unit-05</b>	<b>Automobile Electrical Systems &amp; Body</b> 5.1 Battery- working, construction & rating of battery. 5.2 Ignition system- construction & working of electronic and CDI ignition system. 5.3 Starting system- construction & working of starting motor. 5.4 Charging system- construction & working of alternator 5.5 Wiring system-harnessing & colour codes. 5.6 Lighting system-head light, tail light, indicator light & their circuits. 5.7 Gauges- construction & working of Fuel level gauge, oil gauge and water temperature gauge. 5.8 Use of microprocessor in automobile control systems	<b>14</b>	<b>18</b>
	<b>Total</b>	<b>48</b>	<b>70</b>

<b>Text / Reference Books:</b>		
<b>Titles of the Book</b>	<b>Name of Authors</b>	<b>Name of the Publisher</b>
Automobile Engineering	K. K. Jain and R.B. Asthana	Tata Mcgraw hill
Automobile Mechanics	William Crouse	Tata Mcgraw hill
Automobile Mechanics	SRINIVASAN	Tata Mcgraw hill
Automotive Technology	H.M.Sethi	Tata Mcgraw hill
Automobile Engineering	G.B.S. Narang	Khanna Publication
Auto Mechanics	Harold T. Glenn	Bennett & Mckknight
Automobile Engineering Vol. I and Vol. II	Kirpal Singh	Standard Publication
Automotive Mechanics	Joseph Hitner	--
Automobile Engg.	Kaushik Berman	Foundation Publishing

**C. D.**

- C. D. Prepared By MSBTE under its CAI Package Program.
- C. D. on various Topics of Automobile Engineering By SAE

**METROLOGY & QUALITY CONTROL LAB**  
**(MECH. ENGG. GROUP)**

<b>Subject Code</b> <b>1625506</b>	<b>Practical</b>						<b>Credits</b>  <b>02</b>	
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>	<b>50</b>		
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>ESE</b>	<b>:</b>	<b>50</b>		
	—	—	<b>04</b>	<b>Internal</b>	<b>:</b>	<b>15</b>		
	—	—	—	<b>External</b>	<b>:</b>	<b>35</b>		

**CONTENTS : PRACTICAL**

**Skill to be developed:**

**Intellectual Skills:**

1. To understand principle, working of various measuring instruments.
2. Selection of proper instruments for measurement.
3. Calculation of least count of instrument.
4. Take reading using the instrument
5. Interpret the observation and results
6. Collection and recording of data
7. Analysis of data.

**Motor Skills:**

1. Setting the instruments for zero error adjustment.
2. Proper alignment of the instrument with work piece
3. Handling of instruments
4. Care and maintenance of instruments.
5. Measure the dimensions form the instruments.
6. Calibration and traceability of the instruments
7. Graphical representation of data.

**Notes:**

1. The practical shall be conducted by the subject teacher, by taking actual measurements of different parameters on the jobs prepared by earlier batches in workshop practice or actual measurement of component dimension.
2. The data collected from the practical of basic measuring instruments may be used for experiments of SQC.
3. During practical examination student should measure at least five parameters by using two to three different measuring instruments and evaluation of practical be done considering
  - (a) Selection of appropriate measuring instrument by the examinee.
  - (b) Computation of Least count of instrument used.
  - (c) Correctness of measurements of the measured.

**List of Practical:**

1. Standard use of basic measuring instruments. Surface plate, v-block, spirit level, combination set, filler gauge, screw pitch gauge, radius gauge, vernier caliper, micrometer and slip gauges to measure dimension of given jobs.
2. To find unknown angle of component using sine bar and slip gauges.
3. Study and use of optical flat for flatness testing.
4. Measurement of screw thread elements by using screw thread micrometer, screw pitch gauge.
5. Study and use of dial indicator as a mechanical comparator for run out measurement, roundness comparison.
6. Measurement of gear tooth elements by using gear tooth vernier caliper and span micrometer, verification of gear tooth profile using profile projector,.
7. Testing of machine / machine tool for flatness, parallelism, perpendicularity by autocollimator.
8. Draw the frequency histogram, frequency polygon and ogee for given samples (min 50 reading) and find mean, mode, median.
9. To draw the normal distribution curve and find standard deviation, variance, range
10. To draw and interpret the control limit for variable measurement (X and R chart).

**ADVANCED MANUFACTURING PROCESSES LAB**  
**(MECH. ENGG. GROUP)**

<b>Subject Code</b> <b>1625507</b>	<b>Practical</b>						<b>Credits</b>  <b>02</b>	
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>	<b>50</b>		
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>ESE</b>	<b>:</b>	<b>50</b>		
	—	—	<b>04</b>	<b>Internal</b>	<b>:</b>	<b>15</b>		
	—	—	—	<b>External</b>	<b>:</b>	<b>35</b>		

**CONTENTS : TERM WORK**

**Practical:** Skills to be developed:

**Intellectual skills:**

- 1) To select an appropriate non conventional machining process for required component.
- 2) To write programs for CNC milling machine.
- 3) To specify the requirement for special purpose machines and automation.

To select the maintenance procedure for given machine tool.

**Motor Skills:**

- 1) To execute part programs on CNC milling machine / machining center.
- 2) To repair and maintain machine tools and sub systems.
- 3) To use and operate different hand tools required for repair and maintenance.
- 4) To identify and rectify the faults in the given sub assembly.

- test:**
1. The workshop instructors should prepare specimen job in each shop as demonstration practice before the student (as per the drawing given by subject teacher / workshop superintendent)
  2. Theory behind practical is to be covered by the concerned subject teacher / workshop superintendent.
  3. Workshop diary should be maintained by each student duly signed by respective shop instructors

**List of Practical:**

- 1) Two jobs on CNC milling having following operations – face milling, slotting, Contour machining.  
(Group of two students , each group must use different program for different job dimensions )
- 2) One assignment on part programming on machining center.
- 3) One assignment on machine tool installation procedure.
- 4) Industrial visit to observe automats and report on the tools, fixtures and cams used on automats.
- 5) Industrial visit to observe at least one non traditional machining process and report on visit.
- 6) Dismantling and Assembly of any one – a) Tailstock on lathe b) Apron Mechanism. c) Tapping attachment on drilling machine. d) Lathe Chuck
- 7) Report on mounting and dismounting procedure of following (any two) – a) Milling machine arbor. b) Vertical milling head. c) Tool post
- 8) One assignment on USM, CHM, EBM, AJM, WJM, PAM.

**INDUSTRIAL PROJECT AND ENTREPRENEURSHIP DEVELOPMENT- TW**  
**(MECH. ENGG. GROUP)**

<b>Subject Code</b> <b>1625508</b>	<b>Term Work</b>						<b>Credits</b>
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>	<b>50</b>	<b>02</b>
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>Internal</b>	<b>:</b>	<b>15</b>	
	—	—	<b>04</b>	<b>External</b>	<b>:</b>	<b>35</b>	

<b>Contents :Term Work</b>		
<b>PART A) Industrial Project</b>		
<p>Following activities related to project are required to be dealt with, during this semester</p> <ol style="list-style-type: none"> <li>1. Form project batches &amp; allot project guide to each batch. (Max. 4 students per batch)</li> <li>2. Each project batch should select topic / problem / work by consulting the guide &amp; / or industry. Topic / Problem / work should be approved by Head of department.</li> <li>3. Each project batch should prepare action plan of project activities &amp; submit the same to respective guide.</li> <li>4. At the end of semester, each project batch should submit the action plan and abstract of the project along with list of materials required if project involves fabrication or other facilities required in other kinds of project.</li> <li>5. Action Plan should be part of the project report.</li> </ol>		
<b>Part B: Entrepreneurship Development</b>		
<b>OBJECTIVES:-</b>		
Students will be able to		
<ol style="list-style-type: none"> <li>1) Identify entrepreneurship opportunity.</li> <li>2) Acquire entrepreneurial values and attitude.</li> <li>3) Use the information to prepare project report for business venture. Develop awareness about enterprise management.</li> </ol>		
<b>Contents</b>		<b>Hrs/week</b>
<b>Chapter</b>	<b>Name of the Topic</b>	<b>Hours</b>
<b>Unit-01</b>	<p><b>Entrepreneurship, Creativity &amp; Opportunities</b></p> <p><b>1.1)</b> Concept, Classification &amp; Characteristics of Entrepreneur</p> <p><b>1.2)</b> Creativity and Risk taking.</p> <p><b>1.2.1)</b> Concept of Creativity &amp; Qualities of Creative person.</p> <p><b>1.2.2)</b> Risk Situation, Types of risk &amp; risk takers.</p> <p><b>1.3)</b> Business Reforms.</p> <p>1.3.1) Process of Liberalization. 1.3.2) Reform Policies.</p> <p><b>1.3.3)</b> Impact of Liberalization.</p> <p><b>1.3.4)</b> Emerging high growth areas.</p> <p>1.4) Business Idea Methods and techniques to generate business idea.</p> <p>1.5) Transforming Ideas in to opportunities transformation involves Assessment of idea &amp; Feasibility of opportunity</p> <p>1.6) SWOT Analysis</p>	<b>03</b>

<b>Unit-02</b>	<b>Information And Support Systems</b> <b>2.1) Information Needed and Their Sources.</b> Information related to project, Information related to support system, Information related to procedures and formalities <b>2.2) SUPPORT SYSTEMS</b>  1) Small Scale Business Planning, Requirements.  2) Govt. & Institutional Agencies, Formalities  3) Statutory Requirements and Agencies.	<b>03</b>
<b>Unit-03</b>	<b>Market Assessment</b> 3.1) Marketing -Concept and Importance 3.2) Market Identification, Survey Key components 3.3) Market Assessment	<b>02</b>
<b>Unit-04</b>	<b>Business Finance &amp; Accounts Business Finance</b> 4.1) Cost of Project 1) Sources of Finance 2) Assessment of working capital 3) Product costing 4) Profitability 5) Break Even Analysis 6) Financial Ratios and Significance <b>Business Account</b> 4.2) Accounting Principles, Methodology 1) Book Keeping 2) Financial Statements	<b>03</b>
<b>Unit-05</b>	<b>Business Plan &amp; Project Report</b> 5.1) Business plan steps involved from concept to commissioning Activity Recourses, Time, Cost 5.2) <b>Project Report</b> 1) Meaning and Importance 2) Components of project report/profile <b>(Give list)</b> 5.3) <b>Project Appraisal</b> 1) Meaning and definition 2) Technical, Economic feasibility 3) Cost benefit Analysis	<b>03</b>
<b>Unit-06</b>	<b>Enterprise Management And Modern Trends</b> 6.1) <b>Enterprise Management:</b> - 1) Essential roles of Entrepreneur in managing enterprise 2) Product Cycle: Concept And Importance 3) Probable Causes Of Sickness 4) Quality Assurance Importance of Quality, Importance of testing 6.2) E-Commerce Concept and process 6.3) Global Entrepreneur	<b>02</b>
	<b>Total</b>	<b>16</b>



<b>Text/ Reference Books:</b>		
<b>Titles of the Book</b>	<b>Name of Authors</b>	<b>Name of the Publisher</b>
Entrepreneurship Development	E. Gorden .Natrajan	Himalaya Publishing. Mumbai
Entrepreneurship Development	Preferred by Colombo plan staff college for Technical education.	Tata Mc Graw Hill Publishing co. ltd. New Delhi.
A Manual on How to Prepare a Project Report	J.B.Patel D.G.Allampally	EDI STUDY MATERIAL Ahmadabad (Near Village Bhat , Via Ahmadabad Airport & Indira Bridge), P.O. Bhat 382428 , Gujrat,India P.H. (079) 3969163, 3969153 E-mail : <a href="mailto:ediindia@sancharnet.in">ediindia@sancharnet.in</a> / <a href="mailto:olpe@ediindia.org">olpe@ediindia.org</a> Website : <a href="http://www.ediindia.org">http://www.ediindia.org</a>
A Manual on Business Opportunity Identification & Selection	J.B.Patel S.S.Modi	
National Derectory of Entrepreneur Motivator & Resource Persons.	S.B.Sareen H. Anil Kumar	
New Initiatives in Entrepreneurship Education & Training	Gautam Jain Debmuni Gupta	
A Handbook of New Entrepreneurs	P.C.Jain	
Evaluation of Enterpreneurship Development Programmes	D.N.Awasthi , Jose Sebastian	
The Seven Business Crisis & How to Beat Them.	V.G.Patel	
Entrepreneurship Development of Small Business Enterprises	Poornima M. Charantimath	
Entrepreneurship Development	Special Edition for MSBTE	McGraw Hill Publication
Entrepreneurship Theory and Practice	J.S. Saini B.S.Rathore	Wheeler Publisher New Delhi
Entrepreneurship Development		TTTI, Bhopal / Chandigadh
Entrepreneurship in Action.	Mary Coulter.	Prentice Hall of India Pvt. Ltd., New Delhi.
Fundamentals of Entrepreneurship	Mohanty, S.K.	Prentice Hall of India Pvt. Ltd., New Delhi.

## **2) VIDEO CASSETTES**

NO	SUBJECT	SOURCE
1	Five success Stories of First Generation Entrepreneurs	EDI STUDY MATERIAL
2	Assessing Entrepreneurial Competencies	Ahmedabad (Near Village Bhat , Via Ahmadabad Airport & Indira Bridge), P.O. Bhat 382428 , Gujrat,India P.H. (079) 3969163, 3969153  E-mail : <a href="mailto:ediindia@sancharnet.in">ediindia@sancharnet.in</a> / <a href="mailto:olpe@ediindia.org">olpe@ediindia.org</a>  Website : <a href="http://www.ediindia.org">http://www.ediindia.org</a>
3	Business Opportunity Selection and Guidance	
4	Planning for completion & Growth	
5	Problem solving-An Entrepreneur skill	

**GLOSSARY:****INDUSTRIAL TERMS**

Terms related to finance, materials, purchase, sales and taxes.

**Components of Project Report:**

1. Project Summary (One page summary of entire project )
2. Introduction (Promoters, Market Scope/ requirement)
3. Project Concept & Product (Details of product)
4. Promoters (Details of all Promoters- Qualifications, Experience, Financial strength)
5. Manufacturing Process & Technology
6. Plant & Machinery Required
7. Location & Infrastructure required
8. Manpower ( Skilled, unskilled )
9. Raw materials, Consumables & Utilities
10. Working Capital Requirement (Assumptions, requirements)
11. Market ( Survey, Demand & Supply )
12. Cost of Project, Source of Finance
13. Projected Profitability & Break Even Analysis
14. Conclusion.

**PROFESSIONAL PRACTICES V - TW**  
**(MECH.+CIVIL ENGG. GROUP)**

<b>Subject Code 1625509</b>	<b>Term Work</b>			<b>Full Marks</b>			<b>:</b>	<b>25</b>	<b>Credits 02</b>
	<b>No. of Periods Per Week</b>								
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>External</b>			<b>:</b>	<b>18</b>	
	—	—	<b>04</b>						

<b>Contents :Term Work</b>		<b>Hrs/week</b>
	<b>Activities</b>	<b>Practical Hours</b>
<b>Unit-01</b>	<p><b>Industrial Visits</b> Structured industrial visits be arranged and report of the same shall be submitted by the individual student, to form a part of the term work.(2 visits) Following are the suggested types of Industries/ Fields -</p> <ol style="list-style-type: none"> <li>i) Automobile manufacturing / auto component manufacturing units to observe the working of SPM</li> <li>ii) Refrigeration and air conditioning manufacturing / servicing units / industries / workshops</li> <li>iii) Automobile service stations for four wheelers</li> <li>iv) Co-ordinate measuring machine to observe its construction working specifications and applications.</li> <li>v) Auto Engine Testing unit to gather details regarding the testing procedures/parameters etc.</li> <li>vi) Wheel Balancing unit for light and/or heavy motor vehicles.</li> <li>vii) Food processing unit.</li> <li>viii) Textile industry machinery manufacturing / servicing units.</li> <li>ix) Hydro electric and Thermal power plants.</li> <li>x) Automotive Research Association of India, Pune, Central Institute of Road Transport, Pune, Vehicle Research and Development establishment , Ahmednagar.</li> <li>xi) Engine testing, exhaust gas analysis and vehicle testing</li> <li>xii) PWD workshop.</li> <li>xiii) Safety museum at Central Labour Institute, Sion, Mumbai</li> </ol>	<b>08</b>
<b>Unit-02</b>	<p><b>The Guest Lecture/s</b> From field/industry experts, professionals to be arranged (2 Hrs duration), minimum 4 nos. from the following or alike topics. The brief report to be submitted on the guest lecture by each student as a part of Term work</p> <ol style="list-style-type: none"> <li>a) Electronic fuel injection systems</li> <li>b) Exhaust gas analysis.</li> <li>c) Vehicle testing.</li> <li>d) Transducer application in automobiles.</li> <li>e) Environmental pollution &amp; control.</li> <li>f) Vehicle aerodynamics &amp; design.</li> <li>g) Earth moving machines.</li> <li>h) Automobile pollution, norms of pollution control.</li> <li>i) Biotechnology</li> <li>j) Nanotechnology</li> <li>k) Rapid prototyping</li> <li>l) Programmable logic controllers</li> <li>m) TQM</li> <li>n) MPFI</li> <li>o) Hybrid motor vehicles</li> <li>p) Packaging technology</li> <li>q) Appropriate technology</li> <li>r) Six sigma systems</li> <li>s) LPG / CNG conversion kit.</li> </ol>	<b>10</b>

<b>Unit-03</b>	<p><b>Group Discussion :</b> The students should discuss in group of six to eight students and write a brief report on the same, as a part of term work. The topic of group discussions may be selected by the faculty members. Some of the suggested topics are <b>(any one)</b>-</p> <ol style="list-style-type: none"> <li>i) CNG versus LPG as a fuel.</li> <li>ii) Petrol versus Diesel as a fuel for cars.</li> <li>iii) Trends in automobile market.</li> <li>iv) Load shading and remedial measures.</li> <li>v) Rain water harvesting.</li> <li>vi) Trends in refrigeration Technology.</li> <li>vii) Disaster management.</li> <li>viii) Safety in day to day life.</li> <li>ix) Energy Saving in Institute.</li> <li>x) Nano technology.</li> </ol>	<b>10</b>
<b>Unit-04</b>	<p><b>Seminar : (any 2 topics)</b> Seminar topic should be related to the subjects of fifth semester / topics from guest lectures. Students shall submit a report of at least 10 pages and deliver a seminar (Presentation time – 10 minutes for a group of 2 students)</p>	<b>12</b>
<b>Unit-05</b>	<p><b>Mini Projects : (in a group of 4-5 students)</b></p> <ol style="list-style-type: none"> <li>1) Design / drawing of simple jigs, fixtures</li> <li>2) Thermocouple based temperature controller.</li> <li>3) Pump on / off timer</li> <li>4) Models of jigs / fixtures</li> <li>5) Layout design of SSI units / factory / workshop of the institute</li> </ol> <p><b>Models of material handling route systems</b> OR</p> <p><b>Modular Course on any one of the suggested or alike relevant topic be undertaken by a group of students (Min 10) :</b></p> <ol style="list-style-type: none"> <li>a) LPG/CNG conversion of vehicles</li> <li>b) Advance features in CAD – CAM</li> <li>c) basics of PLC programming</li> <li>d) die design</li> <li>e) JIT techniques</li> <li>f) Non traditional manufacturing methods</li> <li>g) jigs and fixture design</li> <li>h) 3D Modeling</li> <li>I) finite element method</li> <li>j) Mechatronics</li> <li>k) Advanced computer programming</li> <li>l) maintenance of home appliances</li> <li>m) value stream mapping</li> <li>n) piping technology</li> </ol>	<b>04</b>
<b>Unit-6</b>	<p><b>Student Activities</b> – Students in a group of 3 to 4 shall perform <b>ANY TWO</b> of the following activities (Other similar activities may be considered) and write a report as a part of term work.</p> <p><b>Activities :-</b></p> <ol style="list-style-type: none"> <li>1. Collection of data regarding loan facilities or other facilities available through different organizations / banks to budding entrepreneurs</li> <li>2. Survey and interviews of successful entrepreneurs in near by areas</li> <li>3. Survey of opportunities available in thrust areas identified by Government or DIC.</li> <li>4. Measuring Screw thread parameters on floating carriage dial micrometer and select the optimum diameter of wire.</li> <li>5. Survey of data regarding different types of pumps with specifications from manufacturers catalogue, local markets, end users (any other engineering products may be considered for survey)</li> <li>6. Survey of farm implements used by farmers</li> </ol>	<b>04</b>
	<b>Total</b>	<b>48</b>

<b>Text/ Reference Books:</b>		
<b>Titles of the Book</b>	<b>Name of Authors</b>	<b>Name of the Publisher</b>
Nanotechnology	Mark Ratner and Daniel Ratner	Pearson Educatuion, New Delhi
Computer Control of Manufacturing System	Yoram Korem	Mcgraw Hill Publication
Supply Chain Management	Sunil Chopra, Peter Meindl	Pearson Educatuion, New Delhi

**METROLOGY & QUALITY CONTROL - TW**  
**(MECH. ENGG. GROUP)**

<b>Subject Code 1625510</b>	<b>Term Work</b>						<b>Credits</b>
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>	<b>25</b>	<b>01</b>
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>Internal</b>	<b>:</b>	<b>07</b>	
	—	—	<b>03</b>	<b>External</b>	<b>:</b>	<b>18</b>	

**CONTENTS : TERM WORK**

**List of Term Work:-** (Perform any five) :-

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