

# GUJARAT TECHNOLOGICAL UNIVERSITY

## DIPLOMA IN MECHANICAL ENGINEERING

TEACHING SCHEME (w.e.f. 18<sup>th</sup> July '2011 )

### SEMESTER- V

SR. NO	SUB. CODE	SUBJECT	TEACHING SCHEME (HOURS)			CREDITS
			THEORY	TUTORIAL	PRACTICAL	
1	2351901	Thermal Engineering	3	0	0	3
2	2351902	Design of Machine Elements	3	0	2	5
3	2351903	Machine Tools Technology	3	0	0	3
4	2351904	Tool Engineering	3	0	0	3
5	2351905	Estimating, Costing and Contracting	2	0	2	4
6	2351906	Thermal Engineering Practice	0	0	2	2
7	2351907	Machining Practice	0	0	4	4
8	2351908	Tool Design Practice	0	0	2	2
9	2351909	Project – I	0	0	4	4
		<b>Total</b>	<b>14</b>	<b>0</b>	<b>16</b>	<b>30</b>

# GUJARAT TECHNOLOGICAL UNIVERSITY

## DIPLOMA IN MECHANICAL ENGINEERING

### Semester – V

Subject Code : 2351901

Subject Name : **Thermal Engineering**

Sr. No.	Subject Content	Hrs.
1.	<b>Boilers:</b> 1.1 Concepts, functions, features and classification. 1.2 Detail study of fluidized bed combustion, packaged and oil fired boilers. 1.3 Boiler mounting and accessories. 1.4 Boiler draught system. 1.5 Boiler performances testing and heat balance sheet. 1.6 Application and maintenance of boiler. 1.7 Inspection and safety precautions in boiler house.(As per IBR)	5
2.	<b>Steam Prime-Movers:</b> 2.1 Concept of steam prime mover. 2.2 Brief description about heat engine. 2.3 Steam turbine - concept and classification. 2.4 Steam nozzles-types, working and applications. 2.5 Impulse and reaction turbines(constructional and materials details.) 2.6 Compounding of impulse steam turbine.	5
3.	<b>Steam Condensers and Cooling Towers:</b> 3.1 Classification and working of condensers. 3.2 Classification and working of cooling towers.	2
4.	<b>Air Compressors:</b> 4.1 Concepts, functions and classification. 4.2 Working of reciprocating air compressor and rotary air compressor. 4.3 Single stage, multistage and inter-cooling in compressors. 4.4 Power required and efficiency of reciprocating air Compressors-single and two stage.	5
5.	<b>Internal Combustion (I. C.) Engines:</b> 5.1 Concepts and classification. 5.2 I.C. engines parts and their functions. 5.3 Working of two stroke and four stroke cycle Spark Ignition (SI) and Compression Ignition (CI) engines. 5.4 Valve timing of I.C. engine and its explanation on PV diagram. 5.5 Various systems of I.C.engines. 5.6 Carburetion, fuel pump and fuel injectors including Multi Point	10

	<p>Fuel Injectors(MPFI).</p> <p>5.7 Scavenging and Turbocharger.</p> <p>5.8 Performance testing on I.C. engine and its heat balance sheet. Familiarization with IS testing.</p> <p>5.9 Concept of octane and cetane numbers.</p>	
6.	<p><b>Echo-Friendly Fuels:</b></p> <p>6.1 Alternatives fuel-types, properties, compositions, advantages, disadvantages and implementation issues.(This includes mainly Compressed Natural Gas(CNG), Liquefied Petroleum Gas(LPG), and Biodiesel).National and International emission norms.</p> <p>6.2 Systems required for CNG and LPG supply in vehicle.</p> <p>6.3 Compatibility needs-vaporizer for fuel compatibility, piping and allied needs.</p>	3
7.	<p><b>Gas Turbines:</b></p> <p>7.1 Classification, working and application of gas turbine.</p> <p>7.2 Fuels for gas turbine.</p>	2
8.	<p><b>Refrigeration and Air-Conditioning:</b></p> <p>8.1 Introduction , working on PV and TS diagrams and applications of Vapour Compression Refrigeration System (VCRS)and Vapour Absorption Refrigeration System(VARS).</p> <p>8.2 Working of components of vapour compression refrigeration system. Calculation of Coefficient Of Performance and Refrigeration Effect.</p> <p>8.3 Properties and applications of commonly used refrigerants including R22,R134a and R717(Ammonia).</p> <p>8.4 Air conditioning- types and its applications.</p> <p>8.5 Psychrometry and various Air conditioning processes on Psychrometric charts.</p> <p>8.6 Window/Split air conditioners.</p>	5
9.	<p><b>Heat Transfer:</b></p> <p>9.1 Various mode of heat transfer.</p> <p>9.2 Conduction heat transfer, Fourier's law, thermal conductivity and heat transfer through composite wall and cylinders.</p> <p>9.3 Convection heat transfer, Newton's law of convection, Free force convection, coefficient of convection. and</p> <p>9.4 Radiation heat transfer, Stefan and Boltzmann's law, Black concept, emissivity, refractivity, absorptivity. body</p> <p>9.5 Over all heat transfer coefficient.</p> <p>9.6 Heat exchanger : introduction, types and applications</p>	5

**Reference Books:**

1. Thermal Engineering, P.L.Ballaney.
2. Thermal Engineering, A. S. Sarao.
3. Heat Engines, A.R.Basu & T.P.Mukherjee.
4. Heat Engines, Pandya and Shah.
5. Heat Engineering, Vasandani and Kumar.
6. Elements of Heat Engines, Patel and Karamchandani, Vol. I, II, III.
7. An introduction to Energy conversion, Kadambi and Manoharprasad Vol. I, II, III.
8. Thermodynamics and Heat power Engg, Mathur and Mehta.
9. Heat Engines, D. A. Wrangham.
10. Refrigeration and Air conditioning, Domkundwar.

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**DIPLOMA IN MECHANICAL ENGINEERING**  
**Semester – V**

Subject Code : **2351902**

Subject Name : **Design Of Machine Elements**

Sr. No.	Subject Content	Hrs.
1	<p><b>Introduction:</b></p> <p>1.1 General consideration and factors influencing the design of machine elements, design process.</p> <p>1.2 Various materials used in manufacture of machine elements (Metallic, Non-metallic, ferrous and non-ferrous - I.S. designation).</p> <p>1.3 Types of loads, types of stresses, concept of stress concentration and factor of safety.</p> <p>1.4 Standardization and preferred numbers.</p>	06
2	<p><b>Design of Machine Elements Subjected to Direct Stresses:</b></p> <p>2.1 Simple examples of machine elements e.g. link of chain, eye bolt, Punching operation, etc.</p> <p>2.2 Design of knuckle Joint.</p> <p>2.3 Design of cotter Joint.</p> <p>2.4 Design of riveted Joint.</p> <p>2.5 Threaded fasteners.</p> <p>2.6 Design procedure of the screw for power transmission.</p>	10
3	<p><b>Design the Machine Elements Subjected to Bending:</b></p> <p>3.1 Concept of bending moment. Fundamental equation of Bending, Section modulus of various sections, examples of pure bending like levers, beams, axle, etc.</p> <p>3.2 Design procedure for levers. Types of levers, design of cross- section of arms, bosses and pins.</p> <p>3.3 Design of leaf spring.</p>	06
4	<p><b>Design of Machine Elements Subjected to Direct Twisting Moments:</b></p> <p>4.1 Fundamental equation of Twisting Moment and design procedure.</p> <p>4.2 Design of shafts (solid and hollow) on basis of strength.</p> <p>4.3 Design of keys - types and design procedure.</p> <p>4.4 Types and applications of couplings. Design of muff and flange coupling.</p> <p>4.5 Design of closed coiled helical spring, calculation of dimensions (wire diameter, stiffness , number of coils, free length), helical spring-tension and compression both.</p>	08

5	<b>Design Machine Element Subjected to Direct and Bending Stresses:</b> 5.1 Eccentric loading - frame of a machine, clamp, bracket. 5.2 Various types of load on bolts in assembly - design of bolt under static load and calculation of size of foundation bolt for pillar crane.	04
6	<b>Pressure Vessels:</b> 6.1 Types of pressure vessels used in process industries. 6.2 Design of thick cylinders. 6.3 Design of thin cylinders and thin spherical shell.	04
7	<b>Selection Procedure for Bearings:</b> 7.1 Bearings - types, characteristics and commonly used Materials, designation as per IS. 7.2 Design of journal bearings. 7.3 Antifriction bearings: types, advantages, applications. 7.4 Selection procedure of anti-friction bearing. 7.5 Different calculation of bearings : basic dynamic load, load rating, equivalent load, bearing life.	04
	<b>Total</b>	<b>42</b>

### Laboratory Experiences:

Experience Type	Experience Number	Description of Laboratory Experience	Hrs.
Preparatory Activity (Includes Home Assignments Also)	1	a. SI units ,SI prefixes, various conversions. b. Normal values of ultimate tensile stress and yield stress of commonly used materials. c. Area, volume, section modulus, moment of inertia, radius of gyration, etc. for commonly used various sections/shapes. d. Orthographic projections. e. Symbols of threads, surface roughness, geometrical symbols, sections, etc. f. Limits, fits and tolerances.	2

<p>Design Reports and Calculation (Includes Home Assignments Also)</p>	<p>2</p>	<p>From given data, design (Calculating and determining dimensions) :</p> <ol style="list-style-type: none"> <li>I. Knuckle joint</li> <li>II. Cotter joint</li> <li>III. Turn buckle</li> <li>IV. Screw jack</li> <li>V. Flange/Flexible coupling</li> <li>VI. Screw and nut of C clamp.</li> <li>VII. Bell crank lever</li> <li>VIII. Helical spring</li> <li>IX. Leaf spring</li> <li>X. Thick/Thin cylinder</li> <li>XI. Thin spherical shell</li> <li>XII. Journal bearing</li> </ol> <p>NOTE :</p> <ol style="list-style-type: none"> <li>I. Report writing includes calculations and sketches of assembly and details with dimensions (as applicable).</li> <li>II. Each student must be given separate data.(Varying design parameters like Factor of safety, permissible stresses, load, etc.</li> <li>III. Also show specific area under specific stress/es in details drawings using light shade color.</li> </ol>	<p>4</p>
<p>Manual Drafting on Half Imperial Drawing Sheets. Use Both Sides of Drawing Sheets.</p>	<p>3</p>	<p>Draw assembly and detail drawings of followings based on designs reports preparation.</p> <ol style="list-style-type: none"> <li>1. Knuckle joint (as per experience number 2-I).</li> <li>2. Cotter joint and turn buckle(as per experience number 2-II &amp; 2-III).</li> <li>3. Screw jack ((as per experience number 2-IV).</li> <li>4. Flange / flexible coupling (as per experience number 2-V).</li> </ol> <p><b>Note:</b></p> <p>Each sheet should contain details and assembly production drawings including zone and folding mark, limits, fits and tolerances, surface roughness symbols, heat treatment requirements, etc.</p>	<p>16</p>
<p>Seminar Presentation</p>	<p>4</p>	<p>On topic approved by batch faculty, prepare the Seminar. Also present the seminar at least for 10 minutes using Power point Presentation.</p>	<p>4</p>
<p>Visual Aids</p>	<p>5</p>	<p>Collect/Download product catalogues with specifications of various fasteners/items with drawing and their standards.(Like various threaded bolts, nuts, circlips, cylindrical pins, rivets, various types of bearings, various types of springs, etc).Attach the catalogues/printout of downloaded content.</p> <p>Download application situations for knuckle joints , cotter joints, couplings, springs, bell crank levers, screws, etc.</p>	<p>2</p>

Assignments (Home Assignment)	6	Solve the given assignments. One assignment must be on preparation of chart / diagram / poster / graph / drawing / etc on half imperial size of drawing sheet.	-
		Total	28

### **Notes:**

1. Term work report content of each experience should also include following.
  - a. Experience description / data and objectives.
  - b. Skill/s which is / are expected to be developed in student after completion of experience.
  - c. Steps / procedure to execute experience.
2. Term work report of student of regular mode should exclude Distance Learning manual, photocopies, printed content(except visual aids), etc. Focus should be on developing the term work as original efforts of students.
3. Term work should also include experience logbook duly certified by subject teachers.

### **References Books:**

#### **(A) Books:**

1. Machine Design, Pandya and Shah
2. Machine Design, R.C.Patel and A.D.Pandya
3. Machine Design, R.K.Jain
4. Machine Design, TVS Murthy and N.Shanmugam
5. Design of Machine Elements, Joshi and Joshi
6. Machine Design, Black, Paul H.
7. Design Data Hand Book, Msnadevan & Reddy.
8. Design og Machine Elements, Shigley
9. Design data Book , PSG College of technology, Coimbatore.
10. Data Book for Machine Designer , N.R.Chakrabarti
11. Handbook for machine Design, G.N. Maitra and L.G.Prasad
12. Hand book of properties of Engg, Materials and Design Data for M/C Elements A.Shariff.
13. Design of Machine Elements M.F.Spotts,T.E.Shoup, L.E.Hornberger, C.V.Venkatesh(Pearson)

**(B) Indian Standards:**

1. B.I.S. : 1076-1967 Preferred Numbers
2. B.I.S. : 2048-1975 Parallel Keys and Keyways
3. B.I.S. : 2399-1964 Glossary of terms related to rolling bearings
4. B.I.S. : 2709-1964 Slide for the selection of fits
5. B.I.S. : 3823 Methods of evaluating static load ratings of rolling bearings
  - Part 1-1966 Radial ball bearings
  - Part 2-1966 Radial roller bearings
  - Part 3-1966 Thrust ball bearings
  - Part 4-1966 Thrust roller bearings
6. B.I.S. : 3824 Methods of evaluating Dynamic load ratings of rolling bearings
  - Part 1-1966 Radial ball bearings
  - Part 2-1966 Radial roller bearings
  - Part 3-1966 Thrust ball bearings
  - Part 4-1966 Thrust roller bearings
7. B.I.S. : 4215-1967 Needle bearings
8. B.I.S. : 1135-1966 Proportions of leaf springs
9. B.I.S. : 2693-1964 Cast Iron flexible couplings
10. B.I.S. : 1570-1961 Plain Carbon and alloy steel
11. B.I.S. : 1871-1965 Wrought steels
12. B.I.S. : 617 -1959 Aluminum and Al alloys
13. B.I.S. : 2278-1974 Copper and its Alloys

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**DIPLOMA IN MECHANICAL ENGINEERING**  
**Semester – V**

Subject Code: **2351903**

Subject Name: **Machine Tools Technology**

Sr. No.	Subject Content	Hrs.
1.	<p><b>Introduction to Machine Tools Technology:</b></p> <p>1.1 Need, Scope &amp; importance of Machine tools technology in industries.</p> <p>1.2 List of major industries having machine tools in GUJARAT.</p> <p>1.3 Need of attitude, knowledge &amp; skill required for shop floor supervisor in Machine tools based industries.</p> <p>1.6 Recall fundamentals: definitions of machine tool, cutting speed, feed, depth of cut, metal removal rate, surface finish symbols and values, cutting tools and their geometry.</p>	2
2.	<p><b>Grinding and Super finishing Processes:</b></p> <p>2.1 Cutting action of Grinding Wheel.</p> <p>2.2 Grinding Wheels: Types, materials , nomenclature, selection criteria and applications.</p> <p>2.3 Terms associated with Grinding wheel operations.</p> <p>2.4 Grinding and super finishing operations and machines : definition, constructional features, working principles, cutting parameters for “commonly used grinding wheels and work piece materials” and applications of following machine tools.</p> <ul style="list-style-type: none"> <li>• Surface (rotary and sliding) grinding machines.</li> <li>• Cylindrical (centre less, internal, external)grinding machines.</li> <li>• Bench and portable grinder.</li> <li>• Tool and cutter grinding machine.</li> <li>• Profile grinding.</li> <li>• Honing, Lapping and Super finishing.</li> </ul> <p>2.5 Static and dynamic balancing of grinding wheels-need and Methods.</p> <p>2.6 Methods of mounting work piece on cylindrical grinding Machines (Including chuck and mandrel).</p>	8
3.	<p><b>Gear Manufacturing and Gear Finishing Processes:</b></p> <p>3.1 Nomenclature of spur and helical gear, types of gears.</p> <p>3.2 Generating and forming processes.</p> <p>3.3 Gear forming methods –Machine tools specification, working principles, process, cutting tools used with nomenclatures and cutting angles, cutting</p>	8

	<p>parameters.</p> <p>3.4 Gear generating methods –Machine tools specification, working principles, process, cutting tools used with nomenclatures and cutting angles, cutting parameters.</p> <p>3.5 Gear finishing methods-methods and working principles.</p>	
4.	<p><b>Thread Production Methods:</b></p> <p>4.1 Various methods of thread productions, constructional features of thread production machines/processes, their working principles, cutting tools and cutting parameters, applications, advantages and limitations.</p>	4
5.	<p><b>Broaching Machines:</b></p> <p>5.1 Need, types, constructional features and applications.</p> <p>5.2 Broaching methods.</p> <p>5.3 Shapes which can be broached.</p> <p>5.4 Special features and comparison.</p>	2
6.	<p><b>Jig Boring Machine:</b></p> <p>6.1 Need, constructional features, working principle and applications.</p>	2
7.	<p><b>Single Spindle and Multi Spindle Automats:</b></p> <p>7.1 Need, constructional features, working principle and applications.</p>	2
8.	<p><b>Special Purpose Machine Tools:</b></p> <p>8.1 Need, factors affecting constructional design and applications.</p> <p>8.2 Comparison of SPM with other automates.</p>	2
9.	<p><b>Nonconventional Methods of Machining:</b></p> <p>9.1 Need, constructional features, working principles ,tools, working parameters and applications: (ECM, EDM, USM, ECG, AJM, Plasma beam, laser, plasma arc machining, Electro beam machining, chemical machining.)</p>	6
10	<p><b>CNC Machines (Computerized, Numerical Control):</b></p> <p>10.1 Evolution of CNC, definitions of NC, CNC, CAM and DNC.</p> <p>10.2 Need of CNC.</p> <p>10.3 Concept of numerical control.</p> <p>10.4 Selection criteria for CNC.</p> <p>10.5 Methods of machine controls.</p> <p>10.6 Constructional features of CNC, elements of CNC and their functions with working principles.</p> <p>10.7 Classifications of CNC Machines.</p> <p>10.8 Various motors and controls used .</p> <p>10.9 Axes nomenclature.</p> <p>10.10 Latest development in CNC machines.</p>	6
	<b>Total</b>	42

### **References Books:**

1. Machine tools technology, G. S. Kandaswami.
2. All about machine tools, Gerling.
3. Machine tools, B. Chennov.
4. Machine tool Vol.-I to IV, Achercan.
5. Metal cutting technology & Experiments, K. G. Chaniramani.
6. Engineering Productivity Vol.1 & 2, W F Walker.
7. Principles of Engineering Production, Lissamay & Martin.
8. Production Engineering Sciences, Dr. P. C. Pande & C. K. Singh.
9. Fundamental of Metal Machining and Machine Tools, Boothroyd.
10. The Art of Tool & Cutter Grinding, S. P. Narang.
11. Production Technology, HMT.

# GUJARAT TECHNOLOGICAL UNIVERSITY

## DIPLOMA IN MECHANICAL ENGINEERING

### Semester – V

Subject Code : 2351904

Subject Name : Tool Engineering

Sr. No.	Subject Content	Hrs.
1.	<b>Introduction:</b> 1.1. Concept, meaning and definitions of various terminology used, including tool, tool design, tool engineering, etc. 1.2. Tool engineering-functions, services and assistance, organizational structure, intra and interrelationship in an organization. 1.3. Tool engineer - characteristics, duties, responsibilities and importance. 1.4. Common troubles, problems, and troubleshooting approaches used in tool engineering.	2
2.	<b>Process Planning, Economy and Estimation in Tool Engineering:</b> 2.1 Process planning-concept, meaning, , importance, functions, procedure and forms used. 2.2 Information required for process planning and information available from process planning. 2.3 Applications of process & tool plans in a given situation. 2.4 Economy-concept, meaning, importance and principles in tool engineering. 2.5 Universal acts & their elements of a manufacturing operation with suitable simple example. 2.6 Cost-types, methods for calculation and ways to reduce. 2.7 Safety-concept, meaning, importance and norms for tool engineering environment. 2.8 Estimation-concept, meaning, definition, importance, principles, steps, procedure and forms. 2.9 Process planning, estimation of time and estimation of cost for various tool components (having more than 6 operations).	8
3.	<b>Introduction to Tool Design:</b> 3.1 Define, compare and differentiate tool, cutting tool and machine tool. 3.2 Tools-types, classification, features & applications 3.3 Tool materials-types, classification, composition, properties, cutting parameters (for various work piece materials), applications and selection criteria. 3.4 Heat treatment-types, necessity, process, selection criteria and applications for various tool components. 3.5 Tool design-importance, elements, steps, procedure and examples.	4

4.	<p><b>Cutting Tools Selection:</b></p> <p>4.1 Cutting tools-types, classification and applications.</p> <p>4.2 Geometry, nomenclature/signature and BIS/ISO standards for single point cutting tools, twist drills, hole mills, reamers, plain milling cutter, side &amp; face milling cutter and end mills.(HSS based).</p> <p>4.3 Criteria for selection of cutting tools for given application /situation.</p> <p>4.4 Carbide tips/inserts-types, classification, BIS/ISO codification/designation, need, cutting parameters for various work piece materials, selection criteria and applications.</p> <p>4.5 Grinding/resharpening of cutting tools as per given geometry (Demonstration for single point and multi point cutting tools).</p> <p>4.6 Form tools-types, importance, nomenclature and applications.</p> <p>4.7 Correction - meaning, need and graphical method of applying correction.</p> <p>4.8 Tool setting devices and tool setting machines used for CNC machines.</p>	4
5.	<p><b>Design of Jigs and Fixtures:</b></p> <p>5.1 Introduction - concept, purpose, definitions, principles and differences of jigs and fixtures.</p> <p>5.2 Location and clamping- principles, types, features, working, importance and applications.</p> <p>5.3 Fool proofing and ejecting.</p> <p>5.4 Jig- concept, meaning, types, applications, working, components, design steps, design and selection criteria.</p> <p>5.5 Fixture-concept, meaning, types, applications, working, components, design steps, design and selection criteria.</p> <p>5.6 Modular concept of JIG &amp; fixture and its application.</p>	9
6.	<p><b>Design of Press Tools:</b></p> <p>6.1 Press working processes.</p> <p>6.2 Press tools: Introduction, features, types, working, components and their functions.</p> <p>6.3 Concept, meaning, definitions and calculations of press tonnage and shut height of press tool.</p> <p>6.4 Cutting Die Design - General aspects and steps.</p> <p>6.5 Shear action in die cutting operation.</p> <p>6.6 Centre of pressure: Concept, meaning, definition, methods of finding and importance.</p> <p>6.7 Die clearance: Concept, meaning, definition, reasons, effects and methods of application.</p> <p>6.8 Cutting force: Methods to calculate and methods of reducing.</p> <p>6.9 Scrap strip layout:- Concept, importance, method to prepare, and determining percentage stock utilization.</p> <p>6.10 Design methods and design of die block, punch, punch support and other die components.</p> <p>6.11 Types, working, and applications of stock stop, pilots, strippers and knockouts.</p> <p>6.12 Design of cutting die-types and selection criteria for different</p>	12

	<p>components.</p> <p>6.13 Cutting dies &amp; die sets-types, working, features, applications and selection criteria.</p> <p>6.14 Types, terminology, features, elements, working, applications and selection criteria for bending, forming, drawing and forging dies.</p>	
7.	<p><b>Design of Limit Gauges:</b></p> <p>7.1 Elements, types and application of limit gauges.</p> <p>7.2 Gauge materials, their selection and heat treatment.</p> <p>7.3 Taylor's principles of gauge design.</p> <p>7.4 Types and methods to provide gauge tolerances.</p> <p>7.5 Design steps and design of plug &amp; ring / snap gauge for given dimension and application.</p>	3
	<b>Total</b>	42

### **Reference Books:**

1. Fundamentals of tool design, ASTME PHI.
2. Tool design Donaldson & Lecain, TME.
3. Tool engineering, Doyal.
4. Principles of tool & jig design, M. H. A. Kempster.
5. Die design fundamentals, J. R. Paquino Industrial press.
6. Production tooling equipments, S. N. Parsons.
7. Production engineering science, Pandey-sign Standard publishers.
8. Design data book, K. Mahadeven Reddy, BPB, Delhi.
9. Design data book, P S G.
10. An introduction to jig & tool design, M.H.A. Kempster Mc GH. Publication
11. Jigs and fixture design Produced by institution of Production engineering.
12. Basic die making D. Engine Ostergard Mc GH Publication
13. Jigs and fixture P. H. Joshi TMGH publication
14. Production technology HMT
15. BIS 1983,3019,2163 for single point Cutting tool  
 BIS 5101 for twist drills  
 BIS 5989 for hole mills  
 ISO 236/II for reamers  
 BIS for plain milling cutter  
 BIS 6308 for S/F milling cutter  
 BIS 6353 for end mills
16. ISO for carbide inserts.

# GUJARAT TECHNOLOGICAL UNIVERSITY

## DIPLOMA IN MECHANICAL ENGINEERING

### Semester – V

Subject Code : **2351905**

Subject Name : **Estimating, Costing And Contracting**

Sr. No.	Subject Content	Hrs.
1.	<b>Introduction to ECC:</b> 1.1 Need, Scope & importance of ECC in industries. 1.2 Need of attitude, knowledge & skill required for ECC. 1.3 Difference between costing and estimating.	1
2.	<b>Elements of Cost and Overhead Allocation:</b> 2.1 Terminology associated with various cost elements and their classification. 2.2 Terminology associated with overheads, their classification and allocation. 2.3 Determination of selling price and catalogue price. 2.4 Depreciation and obsolescence : Definition, Types Different methods of calculating depreciation. 2.5 Determination of cost of production. 2.6 Concept of Machine Hour Rate (MHR). 2.7 Method to calculate MHR for any machine/machine tool. 2.8 Example to calculate MHR of Lathe, Milling, Drilling, Grinding and Press tool.	5
3.	<b>Cost Estimation of Welding:</b> 3.1 Elements of cost in welding. 3.2 Factors effecting welding cost. 3.3 Estimating cost elements in gas and arc welding. 3.4 Estimation of production cost of given welding job for above methods.	2
4.	<b>Cost Estimation of Forging, Casting, Machining and Press Tools:</b> 4.1 Cost terminology associated with each shop(i.e. forging shop, machine shops(Turning, Milling, Drilling, Cylindrical grinding, Keyway milling/Slotting/Broaching and Gear cutting), foundry shop and press shop(Punching and bending). 4.2 The procedure of calculating material cost of a product for each shop. 4.3 Procedure of estimating cost of forging dies. 4.4 Procedure of estimating forging cost. 4.5 Procedure of estimating cost of pattern making. 4.6 Procedure of estimating foundry cost. 4.7 The terminology associated with machine shop estimation.	11

	<p>4.8 Procedure of estimating cost of machined part</p> <p>4.9 Procedure of estimating cost in sheet metal shop.</p> <p>4.10 For given data compute cost of forging, casting, pattern making, machining and sheet metal.</p> <p>4.11 Determine selling price of given parts made by forging, casting, pattern making, machining and sheet metal process.</p>	
5.	<p><b>Break Even Analysis:</b></p> <p>5.1 Classification of costs, Fixed and variable costs, Classification of given set of costs as fixed and variable, Relationship between the costs and quantity of production.</p> <p>5.2 Break Even Chart :</p> <ul style="list-style-type: none"> <li>- Definition of Break Even Point (BEP) and its needs in industry.</li> <li>- Procedure of construction of Break Even Chart.</li> <li>- Assumptions made in constructing Break even chart.</li> <li>- Calculation of B.E.P. analytically and graphically.</li> <li>- Margin of safety, its importance and its derivation.</li> <li>- Effect of changing various parameters on B.E.P.</li> <li>- Define and derive profit/volume ratio.</li> <li>- Compute profit/volume from the given data.</li> </ul>	3
6.	<p><b>Problems and Solution of Cost:</b></p> <p>6.1 Problem of cost reduction.</p> <p>6.2 Areas of cost reduction. (Explain in brief)</p> <p>6.3 Identify the factors to reduce the cost of production</p> <p>6.4 Modern tools and techniques of cost reduction in brief.</p>	2
7.	<p><b>Budgeting and Industrial Accounting:</b></p> <p>7.1 Define Budget and Budgetary control.</p> <p>7.2 Purpose of budget.</p> <p>7.3 Various types of budgets.</p> <p>7.4 Benefits of budget.</p> <p>7.5 With given example, interpret industrial budget.</p> <p>7.6 Explain various accounting terminology like book value, Net Present Value, Work in progress, Gross Domestic Product (GDP), balance sheet terminology, etc.</p> <p>7.7 Explain in brief different accounts used in industrial accounting.</p> <p>7.8 Interpret the balance sheet of a given industry.</p>	2
8.	<p><b>Contracting:</b></p> <p>8.1 Define contracts and its characteristics.</p> <p>8.2 Types of contract.</p> <p>8.3 Advantages of contract</p> <p>8.4 Provision of different conditions in a contract.</p> <p>8.5 Documents required in an engineering contract (explain).</p>	2
	<b>Total</b>	28

## Laboratory Experiences:

Experience Type	Experience Number	Description of Laboratory Experience	Hrs.
Preparatory Activity (Includes Home Assignments Also)	1	g. Various equations to calculate area and volume of commonly used shapes. h. Densities of commonly used materials. i. Process parameters of various manufacturing processes (Covered in this subject) for commonly used materials. j. Various equations used to calculate process(Covered in this subject) times.	2
Market Collection (Includes Home Assignments Also)	2	Collect the finished parts from industries/market/scrap merchants consisting: I. Five to six machining operations like cutting, turning, threading, grinding, milling, drilling, etc.(Minimum FIVE). II. Welded parts (Minimum THREE) III. Casted parts (Minimum THREE) IV. Forged parts (Minimum TWO) V. Sheet metal parts (Minimum THREE having blanking/Piercing/Bending).  Note: Each student will be assigned to bring at least one specified part so that all varieties of about 16 parts are collected in a batch. All parts must be brought in first week duration only. Parts are to be approved by teacher.)	2
AutoCAD Drafting	3	Each student will draft 2D production drawing for the part he/she has brought. All batch student will interchange their part drawing print and will get photocopy so that each student will have drawings of all parts .	4
Cost Estimation	4	Estimate pattern cost for casting parts (Also sketch pattern with all dimensions).Estimate material cost and total production cost for casting parts.	14
	5	Estimate forging die cost for forged parts(Also sketch die with all dimensions). Estimate material cost and total production cost for forged parts.	
	6	Estimate material cost and total production cost for remaining parts.	
Download, Seminar Presentation And Shop Talk(Includes Self	7	Download minimum two balance sheets of any Indian industries and interpret them.	4
		Download minimum two contract drafts/conditions between two firms (One should be National and another should be international) and interpret	

/ Home Assignments Also)		them.	
		Download videos/content on machining time estimation standards/norms/procedure.	
		On topic approved by batch faculty, prepare the Seminar. Also present the seminar at least for 10 minutes using Power point Presentation.	
		Deliver the talk on your experience for market collection of parts. Also prepare the report on this.	
Tutorials(Home Assignment)	8	Solve given tutorials on budgets and break even analysis.	-
Case Study	9	Select and get it approved from batch teacher, any one field/factory base case and analyze the case in context of cost reduction. Suggest your opinions for cost reduction methods.	2
Assignments (Home Assignment)	10	Solve the given assignments.	-
		Total	28

**Notes:**

1. Term work report content of each experience should also include following.
  - a. Experience description / data and objectives.
  - b. Skill/s which is / are expected to be developed in student after completion of experience.
  - c. The specifications of machines / equipments / devices / tools / instruments /items/elements which is / are used to carry out the operations for cost estimation.
  - d. Process parameters / setup settings' values applied to carry out operations for cost estimation.
  - e. Steps / procedure to execute experience.
  - f. Information on recent machines / equipments / devices / tools / instruments /items available in market to carry out the operations.
  - g. Special / Additional notes or remarks.
2. Term work report of student of regular mode should exclude Distance Learning manual, photocopies(except part drawing of other students) , printed content, etc. Focus should be on developing the term work as original efforts of students.
3. Term work should also include experience logbook duly certified by subject teachers.

### **Reference Books:**

1. Mechanical Estimating and Costing, Banga and Sharma
2. Mechanical Estimating and Costing, Shrimali and Jain
3. Mechanical Costing and Estimation, Singh and Khan
4. Learning Package in E.C.C., TTTI, Bhopal
5. Fundamentals of P.W.D. Accounts and Procedures, Pandya.
6. Construction Management and Accounts, Vajirani and Chandola
7. L.P.in Industrial Management, TTTI, Bhopal
8. A Text book of Industrial Engineering, Mansurali and Dalela

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**DIPLOMA IN MECHANICAL ENGINEERING**  
**Semester – V**

Subject Code : **2351906**

Subject Name : **Thermal Engineering Practice**

**Laboratory Experiences:**

<b>Experience Type</b>	<b>Experience Number</b>	<b>Description of Laboratory Experience</b>	<b>Hrs.</b>
Preparatory Activity (Includes Home Assignments)	1	k. Related SI units and their conversions l. Thermodynamic properties. m. Reading of steam tables. n. Interpretation of Molier chart. o. Thermodynamic laws. p. Thermodynamic processes.	2
Demonstration and Study (Video/ Movie/Cut Sections /Models May Be Used in Absence of Required Machine/ Equipment/ Device.)	2	Compare the boilers on the following aspects: Types, working, application and capacity.	4
	3	Boiler mountings and accessories.	
	4	Various types of condensers and cooling towers.	
Visual Aids	5	Collect / Download product catalogues with specifications of various types of boilers, boiler mountings and boiler accessories.	2
	6	Collect / Download product catalogues with specifications of various types of Energy Conservation equipments/devices and heat exchangers of recent trends.	
Performance	7	Performance test of air compressor.	16
	8	Disassemble, assemble and inspection of <ul style="list-style-type: none"> <li>• Fuel pump.</li> <li>• Multipoint fuel injection, echo friendly fuel Injectors.</li> </ul>	

	9	a. Performance test and heat balance sheet of I.C. Engine.(Petrol and Diesel both) b. Morse test of IC Engine.	
	10	Valve timing diagram of given IC Engine.	
	11	Determine Coefficient Of Performance(COP) of Vapor compression refrigeration system.	
	12	Determine thermal efficiency of heat exchanger.	
Download, Seminar Presentation And Lab. Talk (Copy Downloaded Content and Seminar of Whole Batch In One /One Set of Cd/Dvd )	13	Download videos for working of multi-cylinder IC Engines and explain in group.	4
		Download videos for working of cooling towers and explain in group.	
		Download videos/content on recent trends in effective and efficient heat transfer methods and discuss with group.	
		On topic approved by batch faculty, prepare the Seminar. Also present the seminar at least for 10 minutes using Power point Presentation.	
Live Learning (Home-Self Assignment)	14	1. Prepare student for live learning. 2. Study activities through powerful observation. 3. Visit nearby any CNG/LPG refilling station and prepare the report on refilling system.	-
Tutorial (Home Assignment)	15	Solve given examples on boiler performance/efficiency and heat balance sheet.	-
		Solve given example on steam condenser.	
		Solve given example on air compressor.	
		Solve given example on heat exchanger.	
Industrial Visit	16	1. Visual inspection of actual working of boiler during industrial visit. The report should include : <ul style="list-style-type: none"> <li>• Type of boiler.</li> <li>• Capacity, temperature, pressure.</li> <li>• Use of steam.</li> <li>• Locations of mounting/accessories</li> <li>• Types of fuel used</li> <li>• Water/steam and flue gas path.</li> <li>• IBR followed.</li> </ul> 2. Industrial visit of at least two related industries.	-
Assignments (Home Assignment)	17	Solve the given assignments. One assignment must be on preparation of chart / diagram / poster / graph / drawing / cycle / etc on half imperial size drawing sheet.(For Thermal Engineering subject).	-
		Total	28

## Notes:

1. Term work report content of each experience should also include following.
  - a. Experience description / data and objectives.
  - b. Skill/s which is / are expected to be developed in student after completion of experience.
  - c. Drawing of experience / setup with labels/nomenclature to carry out the experience
  - d. The specifications of machines / equipments / devices / tools / instruments /items/elements which is / are used to carry out and to check experience.
  - e. Process parameters / setup settings' values applied to carry out experience.
  - f. Steps / Process description to execute experience.
  - g. Information on recent machines / equipments / devices / tools / instruments /items available in market to carry out the experience.
  - h. Special / Additional notes or remarks.
2. Term work report of student of regular mode should exclude Distance Learning manual, photocopies & printed content(except visual aids), etc. Focus should be on developing the term work as original efforts of students.
3. Term work content of industrial visit report should also include following.
  - a. Brief details of industry visited.
  - b. Type ,location, products, rough layout, human resource, etc of industry.
  - c. Details, description and broad specifications of machineries/processes observed.
  - d. Safety norms and precautions observed.
  - e. Student's own observation on Industrial environment, culture and attitude.
  - f. Any other details / observations asked by accompanying faculty.
4. Term work should also includes experience logbook duly certified by subject teachers.
5. Term work is to be defended (along with term work) with practical examination by external and
  - i. internal examiners .Practical examination will include followings:
    - Viva
    - Explanation of working of any one machine, equipment, devise or setup (using machine or model) like any one boiler, any one IC engine, any turbine, any heat exchanger, etc.
    - Performance of any one experience from experience number 7-12.

## **Reference Books:**

1. Thermal Engineering, P. L. Ballaney
2. Thermal Engineering, A. S. Sarao
3. Heat Engines, A. R. Basu & T. P. Mukherjee
4. Heat Engines, Pandya and Shah.
5. Heat Engineering, Vasandani and Kumar.
6. Elements of Heat Engines, Patel and Karamchandani Vol. I, II, III.
7. An introduction to Energy conversion, Kadambi and Manoharprasad Vol. I, II, III
8. Thermodynamics and Heat power Engg, Mathur and Mehta.
9. Heat Engines, D. A. Wrangham.
10. Refrigeration and Air conditioning, Domkundwar.

# GUJARAT TECHNOLOGICAL UNIVERSITY

## DIPLOMA IN MECHANICAL ENGINEERING

### Semester – V

Subject Code : 2351907

Subject Name : Machining Practice

#### Laboratory Experiences:

Experience Type	Experience Number	Description of Laboratory Experience	Hrs.
Preparatory Activity (Includes Home Assignments)	1	q. Cutting speed, feed, depth of cut and Metal Removal Rate (MRR). r. Various cutting tools materials, properties and applications. s. Various carbide inserts and ISO codification. t. Calculate RPMs for Lathe, Milling cutter and drill spindle based on given data. Use equations. u. Calculate strokes/minute for shaping machine based on given data. Use equations. v. Basic machine tools processes	2
Demonstration And Study (Video / Movie May Be Used In Absence Of Machine Tools)	2	Kinematics and motion transmission of Cylindrical Grinding Machine.	8
	3	Kinematics and motion transmission of broaching Machine.	
	4	Kinematics and motion transmission of gear hobbing and gear shaping machine.	
	5	Constructional features of CNC.	
	6	Tool changing on CNC using Automatic Tool Changer.	
	7	Grinding various cutting tool angles on Tool and Cutter Grinding Machine.	
Visual Aids	8	Collect / Download product catalogues with specifications of various cutting tools including grinding wheels, gear hob cutter, gear shaping cutter, various milling cutters, reamers, broaches, etc.	2
	9	Collect / Download product catalogues with specifications of various machine tools of recent trends including CNCs.	
Job Preparation	10	Grind Single point cutting tool.	36

	11	Prepare a job on centre lathe as per the given drawing (Including plain turning, knurling, threading, boring and cylindrical grinding.)	
	12	Prepare composite job which includes turning, milling, drilling, shaping, boring, threading, slotting, grinding, etc...(Available all major operations). and prepare a report on process planning and route sheet with shop floor layout for given composite job.	
	13	Prepare a plain surface and inclined surface on shaping and surface grinding machine. Also predrill and tap minimum two holes.	
	14	Prepare a job having gear tooth cutting on milling machine using indexing head.	
	15	Prepare a multi start/square thread job-bolt and nut .	
Download, Seminar Presentation and Shop Talk (Copy Downloaded Content and Seminar of Whole Batch In One /One Set Of Cd/Dvd )	16	Download videos for non conventional machining methods and explain in group.	4
		Download videos for gear manufacturing methods, broaching, jig boring and explain in group.	
		Download videos/content on recent trends in metal removing technology and discuss with group.	
		On topic approved by batch faculty, prepare the Seminar. Also present the seminar at least for 10 minutes using Power point Presentation.	
Quiz Competition	17	Arrange quiz competition amongst batch students.	2
Live Learning	18	1. Prepare student for live learning. 2. Study activities through powerful observation. 3. Make them aware and to form a habit to learn at any place, any time , any thing & from any person. 4. Student will prepare a report of minimum 3 pages based on points 1 to 3 above of live learning in machining practice area.	2
Industrial/ Exhibition Visit	19	Visit at least three related industries and prepare a report. Also visit related exhibitions .	-
Assignments (Home Assignment)	20	Solve the given assignments. One assignment must be on preparation of chart / diagram / poster / graph / drawing / etc on half imperial size of drawing sheet.(For subject Machine Tools Technology)	-
		Total	56

## Notes:

1. Term work report content of applicable experience should also include following.
  - a. Experience description / data and objectives.
  - b. Skill/s which is / are expected to be developed in student after completion of experience.
  - c. Drawing of experience / setup with labels/nomenclature to carry out the experience
  - d. The specifications of machines / equipments / devices / tools / instruments /items/elements which is / are used to carry out and to check experience.
  - e. Process parameters / setup settings' values applied to carry out experience.
  - f. Steps / Process description to execute experience.
  - g. Information on recent machines / equipments / devices / tools / instruments /items available in market to carry out the experience.
  - h. Special / Additional notes or remarks.
2. Term work report of student of regular mode should exclude Distance Learning manual, photocopies , printed content(except visual aids), etc. Focus should be on developing the term work as original efforts of students.
3. Term work content of industrial visit report should also include following.
  - a. Brief details of industry visited.
  - b. Type, location, products, rough layout, human resource, etc. of industry.
  - c. Details, description and broad specifications of machineries/processes observed.
  - d. Safety norms and precautions observed.
  - e. Student's own observation on Industrial environment, culture and attitude.
  - f. Any other details / observations asked by accompanying faculty.
4. Term work should also includes workshop log book and experience logbook duly certified by workshop instructors and subject teachers.
5. Term work is to be defended (along with term work) with practical examination by external and internal examiners .Practical examination will include followings:
  - Viva
  - Job preparation of given drawing

## **Reference Books:**

1. Machine tools technology, G. S. Kandaswami.
2. All about machine tools Gerling.
3. Machine tools B.Chennov.
4. Machine tool Vol.-I to IV Achercan.
5. Metal cutting technology & Experiments, K.G.Chaniramani
6. Engineering Productivity Vol.1 & 2, WFWalker.
7. Principles of Engineering Production, Lissamay & Martin.
8. Production Engineering Sciences, Dr. P. C. Pande & C. K. Singh.
9. Fundamental of Metal Machining and Machine Tools, Boothroyd.
10. The Art of Tool & Cutter Grinding, S. P. Narang.
11. Production Technology, HMT.

# GUJARAT TECHNOLOGICAL UNIVERSITY

## DIPLOMA IN MECHANICAL ENGINEERING

### Semester – V

Subject Code : 2351908

Subject Name : Tool Design Practice

Experience Type	Experience Number	Description of Laboratory Experience	Hrs.
Preparatory Activity(Includes Home Assignments)	1	w. Orthographic projections. x. Limits, fits and tolerances. y. Surface roughness symbols. z. Drafting symbols(specifically threads, welding and sections). aa. Heat treatment processes. bb. Tool materials and their applications.	2
Manual Drafting On Half Imperial Drawing Sheets. Use Both Sides Of Drawing Sheets.	2	Various cutting tools including single point cutting tool, twist drill, side and face milling cutter, centre drill type A, form tool.	20
	3	Design and draw details and assembly of jig for given component.	
	4	Design and draw details and assembly of fixture for given component.	
	5	Design and draw details and assembly of blanking and piercing progressive die for given component.	
Reports(Includes Home Assignments)	6	Prepare a report of various cutting tools you have drafted for experience no.2. (Include cutting tool material, its composition, applications and sharpening methods and setups).	
	7	Steps and considerations for designing jig at experience number 3.Include calculations/thumb rules/sketches wherever necessary.	
	8	Steps and considerations for designing fixture at experience number 4. Include calculations/thumb rules/sketches wherever necessary.	
	9	Steps and considerations for designing press tool at experience number 5. Include calculations/ thumb rules/ sketches wherever necessary.	
Visual Aids	10	Collect / Download photographs/ catalogues / images of various types of locators, clamps , jig bushes, etc (related to jigs and fixture)	2

	11	Collect / Download photographs/ catalogues / images of various types of punches, punch holders, pilots, stops, stripper plates, die blocks and die shoes, etc, (related to progressive die - press tools) and various types of dies.	
Download And Seminar Presentation (Copy Downloaded Content And Seminar Of Whole Batch In One /One Set Of Cd/Dvd )	12	Download videos for jigs and fixtures in working conditions.	4
		Download videos for working of various press tool operations.	
		On topic approved by batch faculty, prepare the Seminar. Also present the seminar at least for 10 minutes using Power point Presentation.	
Process Planning (Home Assignments)	13	Prepare process plan of at least five components. Select the components from the designs of jig/fixture/press tool. Process plan must include sequencing of operations, selection of machines, tools required, cutting parameters, and time estimation .Components must be selected from the designs of jig/fixture/press tools student has designed and must have minimum five-six operations.	-
Industrial Visit	14	Visit at least three related industries and prepare a report.	-
Assignments (Home Assignment)	15	Solve the given assignments. One assignment must be on preparation of chart / diagram / poster / graph / drawing / etc on half imperial size of drawing sheet.(For subject Tool Engineering).	-
		Total	28

**Notes:**

1. Term work report content of each experience should also include following.
  - a. Experience description / data and objectives.
  - b. Skill/s which is / are expected to be developed in student after completion of experience.
2. Term work report of student of regular mode should exclude Distance Learning manual, photocopies & printed content(except experience number 10 and 11), etc. However prints ( and their photocopies) for experience numbers 14,15,16 and 17 will be allowed. Focus should be on developing the term work as original efforts of students.
3. Term work content of industrial visit report should also include following.
  - a. Brief details of industry visited.
  - b. Type, location, products, rough layout, human resource, etc of industry.
  - c. Details, description and broad specifications of machineries/processes /utilization of jigs, fixtures and press tools observed.
  - d. Safety norms and precautions observed.
  - e. Student's own observation on Industrial environment, culture and attitude.
  - f. Any other details / observations asked by accompanying faculty.

4. Term work should also include experience logbook duly certified by subject teachers.
5. Term work is to be defended (along with term work) with practical examination by external and internal examiners .Practical examination will include followings:
  - i. Viva
  - ii. Design sketches of assembly and details of jig or fixture or press tool .

### **Reference Books:**

1. Fundamentals of tool design, ASTME PHI.
2. Tool design Donaldson & Lecain, TME.
3. Tool engineering, Doyal.
4. Principles of tool & jig design, M.H.A.Kempster.
5. Die design fundamentals, J. R. Paquino Industrial press.
6. Production tooling equipments, S. N. Parsons.
7. Production engineering science, Pandey-sign Standard publishers.
8. Design data book, K. Mahadeven Reddy, BPB, Delhi.
9. Design data book, P S G.
10. An introduction to jig & tool design, M.H.A. Kempster Mc GH. Publication.
11. Jigs and fixture design, Produced by institution of Production engineering.
12. Basic die making, D. Engine Ostergard Mc GH Publication.
13. Jigs and fixture, P.H.Joshi TMGH publication.
14. Production technology, HMT.
15. BIS 1983,3019, 2163 for single point Cutting tool.  
 BIS 5101 for twist drills  
 BIS 5989 for hole mills  
 ISO 236/II for reamers  
 BIS for plain milling cutter  
 BIS 6308 for S/F milling cutter  
 BIS 6353 for end mills
16. ISO for carbide inserts.

# GUJARAT TECHNOLOGICAL UNIVERSITY

## DIPLOMA IN MECHANICAL ENGINEERING

### Semester – V

Subject Code : 2351909

Subject Name : Project - I

#### Laboratory Experiences:

Experience Type	Experience Number	Description of Laboratory Experience	Hrs.
Preparatory Activity	01	<ol style="list-style-type: none"><li>1. Appreciate the objectives of learning this subject.<ol style="list-style-type: none"><li>a. To study industrial environment , manufacturing service / transformation processes and systems.</li><li>b. To develop engineering and innovative thinking patterns.</li><li>c. To identify problem/s-problem area/s and/or to identify area/s for improvement of select organization.</li><li>d. To suggest probable solution/s for identified problem/s-area/s and /or to suggest probable strategies/solutions for identified area/s of improvement.</li></ol></li><li>2. Student will prepare report on applied fundamentals required for selected organization.</li></ol>	04
STUDY & PRESENTATION	02	Case study and power point presentation: search, study and present to batch an inspirational case which focuses on successful innovation.	04
	03	Attitude-Do's and Don'ts, appreciate need and practice of these in context of industrial environment and culture.	02
	04	<p>Understand basic theories, their span &amp; importance for study of organizational environment /situation / problems /etc. in context of achieving subject objectives. Basic theories includes following.</p> <p>(It is expected that student uses these theories to develop their engineering and innovative thinking pattern, i.e. student uses these theories as their thought drivers to identify/define problems.)</p> <ol style="list-style-type: none"><li>1. Productivity, Innovation, Cost/waste reduction, Safety, Humanity, Ecology/Environment and Quality. (PICSHEQ).</li></ol>	12

		<ol style="list-style-type: none"> <li>2. Cause and effect diagram (Fish bone diagram).</li> <li>3. Critical Path Method /Pre-Evaluation Review Technique (CPM / PERT).</li> <li>4. 5-S Strategies.</li> <li>5. 7-S Framework.</li> <li>6. SWOT analysis.</li> <li>7. Value Analysis.</li> <li>8. Check sheets.</li> <li>9. Flow diagram.</li> <li>10. Other/s included by concerned teacher.</li> </ol> <p>After understanding basic theories, student will study, analyse and prepare reports for given separate related cases/problems/tutorials/etc.(separate case / problem / tutorial /etc.-as suitable for each basic theory) covering all basic theories.</p>	
	05	<p>Questioning &amp; reasoning techniques / strategies/approaches and problem solving cycle.</p> <p>After understanding this, student will study, analyse and prepare list of probable questions leading to probable problem solutions for given related case/problem/etc.</p> <p>The objective of this experience is to develop engineering and innovative thinking patterns and developing the attitude of enquiry . Students can use thought drivers.</p>	04
SHODH YATRA	06	<p>Visit :</p> <p>Visit one organisation. (Organization means : Industry / Research Organization / Govt. Organization / socio-technical / technology transfer / application or action research based issues and according to the need of time for solving <b>real life</b> problems.)</p> <ol style="list-style-type: none"> <li>1. Student will prepare report including following. <ol style="list-style-type: none"> <li>a. Brief details of organisation visited.</li> <li>b. Type, location, products / processes / systems / services, rough layout, human resource, etc. of organisation.</li> <li>c. Details, description and specifications of machineries / processes / systems / devices / set up / etc. observed.</li> <li>d. literature research related to the corresponding organization in context of objectives of this subject.</li> <li>e. Study in context of basic theories using thought drivers. ( Refer experience number 03).</li> <li>f. Questions / reasons / problems(real life) identified by students. Use of questioning &amp; reasoning techniques is suggested.</li> </ol> </li> </ol>	18

		<p>g. literature research related to the corresponding probable problems / innovations .</p> <p>h. Improvement areas suggested by students. Use of problem solving cycle is suggested.</p> <p>2. Student will also prepare logbook for visit duly certified by Organizational personnel and Institute's Teacher/s. Suggested format is given at Annexure-I.</p> <p>3. It is required that concerned teacher also visit / follow-up the organization/students.</p>	
	07	<p>Prepare and present IDP (Industry Defined Problem) from Shodh Yatra.</p> <p>Student will prepare report and present power point presentation justifying IDP. Student will also submit IDP in defined format.</p> <p>The format for IDP is given at Annexure-II. This can be further modified by the institute.</p>	12
TOTAL			56

**Notes:**

1. This term work (Project – I, 2351909) has to be preserved and has also to be submitted in semester VI along with subject Project-II.
2. Prepare the term work with A4 size paper,30mm left margin,20mm top, bottom and right margins, Arial font of size 14 for titles and size 12 for detail content, single spacing, prepared in MS Word, printed on both side of paper.
3. Term work report of student of regular mode should exclude distance learning manual, photocopies, pre-printed content, copy of previous work carried out, etc. Focus should be on developing the term work as an original effort of students.
4. Term work (hard copy) should also include experience logbook as per experience number 5(2)-Annexure –I.
5. Semester 5th, teaching scheme is 0-0-4, with 4 credits worth of 150 marks(Out of 150 marks, 50 marks are to be given for Problem Definition. The college, through internal evaluation, will assess the Industry Defined problems, submitted by students . The remaining 100 marks are for the practical exam, to be conducted by the University.)
6. Term work report content should also include following for applicable experience.
  - a. Experience description / data and objectives.
  - b. Skill/s which is / are expected to be developed in student after completion of experience.
  - c. Special / additional task assigned by teacher/s , if any.
7. Each institute will send all the problem definitions to GTU.

8. Students are required to strictly follow the rules and regulations (including safety) issued by institute and organisations. Organizational visit/s are also at the own risk of students.
9. Number of students per group can be decided by the institute / concerned teacher.
10. Suggested guidelines are :
  - a. Facilitation: Students may contact UDISHA Club Coordinator / Teacher / Department / Principal or Chairman / TPO of their Sankul for arranging “Shodh-Yatra” to the organization.
  - b. Any student can go to any organization in or outside his/her Sankul. There exist 25 GTU Sankuls across the state at present. Student can also choose an organization not covered / mentioned in GTU innovation council or Sankuls.
  - c. Students can also take interdisciplinary projects.
  - d. The problem summery may be a concise description of the organization related technical issues which can state the problem, which the student has found out while visiting the organization.
  - e. The problem statement has to be well defined in 3-5 pages with detailed facts and figures as and when possible. The description can have figures / inputs from floor persons from organization / parameters related to specific domain of technology.
  - f. The students while interacting with organization persons have to note down the expected out comes (in 1-2 page) from that particular organization due to the proposed innovation either in product or processes. This will gauge the organizational needs and students progress while working on the final year project.
  - g. The students are advised to do some literature research related to the corresponding problem / innovation both before and after visiting the organization / MSME during summer vacation. They have to suggest some suggestions about the issues based on literature research of corresponding problems / projects in feasible cases.
  - h. For any query please mail to [gtu\\_innovation\\_council@gtu.edu.in](mailto:gtu_innovation_council@gtu.edu.in).

ANNEXURE – I

SUGGESTED FORMAT FOR LOG BOOK

NAME OF STUDENT			
ENROLLMENT NUMBER OF STUDENT			
CONTACT NUMBER :			
EMAIL ID			
RESIDENTIAL ADDRESS			
NAME AND ADDRESS OF ORGANISATION , INCLUDING NAME AND CONTACT DETAILS OF CONTACT PERSON			
ACTIVITIES			
DATE	ACTIVITIES CARRIED OUT	INITIAL OF ORGANISATION REPRESENTATIVE	INITIAL OF CONCERN TEACHER

ANNEXURE – II

FORMAT FOR IDP

**INDUSTRY DEFINED PROBLEM / PROJECT (IDP) DESCRIPTION FORM**

**STUDENT PARTICULARS**

<b>NAME</b>			
<b>ENROLLMENT NUMBER</b>			
<b>MOBILE NO.</b>	<b>1.</b>		<b>2.</b>
<b>EMAIL</b>			
<b>NAME OF INSTITUTE</b>			
<b>ADDRESS WITH CONTACT DETAILS OF FATHER / GUARDIAN</b>	<b>PRESENT:</b>		
	<b>PERMENENT:</b>		
<b>BRANCH</b>	<b>DIPLOMA IN MECHANICAL ENGINEERING.</b>		
<b>SEMESTER</b>	<b>5 TH SEMESTER</b>	<b>YEAR</b>	
<b>NAME AND ENROLMENT NUMBERS OF OTHER TEAM MEMBERS, IF ANY</b>	<b>NAME</b>	<b>ENROLLMENT NUMBER</b>	

**ORGANISATION PARTICULARS**

<b>ORGANISATION</b>	
<b>NAME</b>	
<b>ADDRESS</b>	
<b>NAME , CONTACT DETAILS AND EMAIL ID OF CONTACT PERSON.</b>	<b>NAME:</b>
	<b>CONTACT NUMBER:</b>
	<b>EMAIL ID :</b>

**INDUSTRY DEFINED PROBLEM / PROJECT DESCRIPTION FORM**

**TITLE OF PROBLEM**

<b>TITLE:</b>
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<b>DISCIPLINARY / INTER-DISCIPLINARY</b>	
	<b>DISCIPLINE</b>   <b>DIPLOMA IN MECHANICAL ENGINEERING</b>

**PROBLEM SUMMARY**

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## **DETAILED DESCRIPTION OF PROBLEM**

**EXPECTED OUTCOME OF INDUSTRY DEFINED PROBLEM (IDP)**

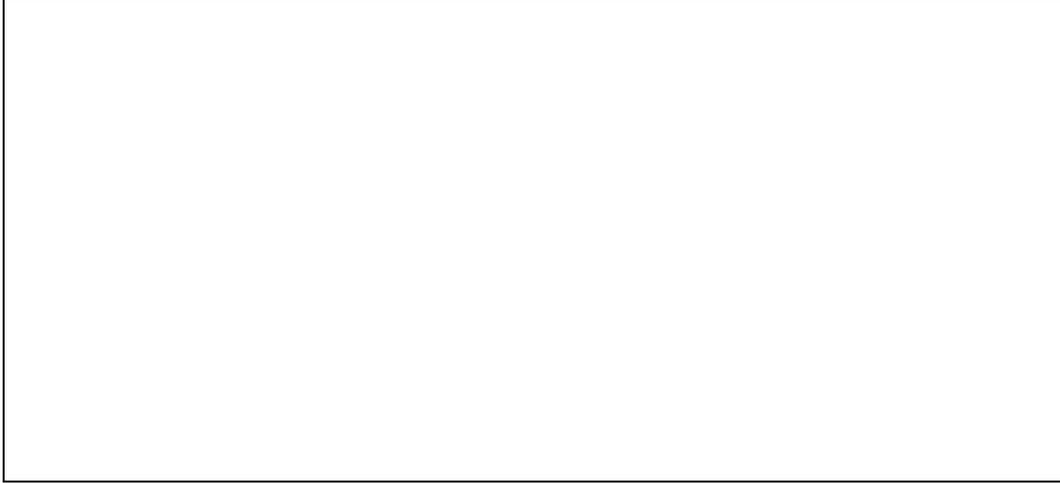
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**OTHER DESCRIPTION (IF ANY)**

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**FEEDBACK AND SUGGESTIONS (Optional)**

**SUGGESTIONS FOR IMPROVING INDUSTRY DEFINED PROBLEM /  
PROJECT (IDP) SCOUTING**

A large, empty rectangular box with a thin black border, intended for users to provide feedback and suggestions. The box is currently blank.