Jharkhand University of Technology
Ranchi, 834010

SYLLABUS

For Diploma Program in

Mechanical Engineering

(Effective from 2024-25)

DEPARTMENT OF MECHANICAL ENGINEERING

(3rd – SEMESTER)

Mechanics of Materials

Subject Code -MEC301

1. Rationale

In this course, Diploma engineers are required to analyse the reasons for failure of components and select the suitable materials for a given applications. For this purpose, it is essential to study the concepts, principles, applications and practices covering stress, strain, stress concentration, weak points, deformations, bending moment and shearing force. The students will also study the basic principles of Finite Elements Analysis and perform stress strain analysis using Ansys software to understand and quantify the effects of real-world conditions on a part. These simulations, will allow Diploma engineers to locate potential problems in a design, including areas of tension and weak spots. FEA becomes a tremendous productivity tool, helping engineers in reducing product development time and cost. Hence, FEA is introduced in this course. It is expected that efforts will be made to provide appropriate learning experiences in the use of basic principles to the solution of applied problems and to develop the required skill and competencies

2. Course Outcomes: At the end of the Course, the student will be able to:

CO-01	Analyse Simple Stresses and Strains on given Structural member that is subjected to Tensile, Compressive and Shear loads by using Destructive Test.
CO-02	Draw Shear force Diagram (SFD) and Bending moment Diagram (BMD) and Also, Analyse Bending Stresses in a Beam using Finite element methods(FEM) software
CO-03	Demonstrate the application of finite element formulations to solve both One dimensional and Two dimensional Problems.
CO-04	Demonstrate the application of FEM software for Validation of both One dimensional and Two dimensional Problems

3. Course Content

Week	CO	PO*	Lecture (Knowledge)	Tutorial (Activity)	Practice (Skill)
1	01	01	1. Introduction to Force- Types of Forces-Resolution of forces	Refer Table 1	Resolution of forces by Graphical Method
			2. Problems on Resolution of forces- Analytical Method		Verification of Forces by Lami's Theorem
			3. Problems on Resolution of forces- Analytical Method		
2	01	01	1. Types of Loads-Tensile, Compression, Shear, Impact, Stress- Types- Strain- Types- - Hooks Law- Young's Modulus		Conduct Tensile test for the given Specimen and Determine Stress- Strain- Young's Modulus, Yield Stress- Maximum Stress-

			2. Stress - Strain Diagram - Elastic constants- Linear strain, Lateral Strain, Poison's Ratio, Volumetric Strain, Bulk Modulus, Rigidity Modulus , Fatigue - Endurance Limit 3. Stress concentration, Factor of Safety(FOS), Concept of Temperature stresses	Refer Table 1	Breaking Stress- % Elongation in Length and % Reduction in Area Also, Draw Stress- Strain Diagram for the above Parameters
3	01	01	1. Simple Problems on Stress, Strain and Elastic constants 2.. Simple Problems on Stress, Strain and Elastic constants 3. Simple Problems on Stress, Strain and Elastic constants	Refer Table 1	Conduct Compression test for the given Specimen and Determine Stress- Strain- Young's Modulus, Yield Stress- Maximum Stress- % Reduction in Length and % Increase in Area Also, Draw Stress- Strain Diagram for the above Parameters
4	01	01	1. Problems on Members subjected to combined Stresses 2. Problems on Members subjected to combined Stresses 3. Problems on Members subjected to combined Stresses	Refer Table 1	Conduct Shear test for the given specimen
5	02	02	1. Types of Beams-Types of Loads acting on Beams- Concept of Shear force - Bending moment 2 Draw Shear force Diagram (SFD) and Bending Moment Diagram (BMD) for Cantilever subjected to Point Load and Uniformly Distributed loads (UDL) 3. Draw Shear force Diagram (SFD) and Bending Moment Diagram (BMD) for Cantilever subjected to Point Load and Uniformly Distributed loads (UDL)	Refer Table 1	Conduct Bending test for the given specimen

6	02	02	1. Draw Shear force Diagram (SFD) and Bending Moment Diagram (BMD) for a Simply supported beam subjected to Point Load and Uniformly Distributed loads (UDL) 2. Draw SFD and BMD for Simply supported and Cantilever beam subjected to Point Load and UDL Draw Shear force Diagram (SFD) and Bending Moment Diagram (BMD) for a Simply supported beam subjected to Point Load and Uniformly Distributed loads (UDL) 3 Draw SFD and BMD for Simply supported and Cantilever beam subjected to Point Load and UDL Draw Shear force Diagram (SFD) and Bending Moment Diagram (BMD) for a Simply supported beam subjected to Point Load and Uniformly Distributed loads (UDL)	Refer Table 1	Present You tube videos in Stress, Strain and Bending Stresses on Different mechanical members Prepare a report on the observations made Eg: https://www.youtube.com/watch?v=C-FEVzI8oe8
7	02	02	1. Pure Bending- Assumptions- Neutral Axis- Bending Equation 2. Problems on Bending Equation 3. Problems on Bending Equation	Refer Table 1	Present You tube videos in Stress, Strain and Bending Stresses on Different mechanical members Prepare a report on the observations made
8	03,04	01	1. Introduction to Finite Element Methods (FEM), Need-Back Ground 2. Methods employed in FEM- Steps in FEM 3. Advantages and Disadvantages, Limitations, Applications of FEM-Concept of Discontinuity	Refer Table 1	Practice on FEM software (Eg: Ansys)
9	02,03,04	01,02,04	1. Phases of FEA(Finite Element Analysis) 2. Discretization Process 3. Meshing –Element type	Refer Table 1	Validate Bending Equation Problems solved in Week 7 using FEM software (Eg: Ansys)
10	02,03,04	01,02,04	1. Stiffness Matrix of a Bar Element 2. Global Stiffness Matrix- Properties of stiffness matrix	Refer Table 1	Validate Bending Equation Problems solved in Week 7 using FEM software (Eg: Ansys)

			3. Boundary Conditions- Methods –Types		
11	03,04	02,04,07	Problems on 1-D elements	Study the latest technological changes in this course and present the impact of these changes on industry	Validate using FEM software (Eg: Ansys)
12	03,04	02,04,07	Problems on 1-D elements		Validate using FEM software (Eg: Ansys)
13	03,04	02,04,07	Problems on 2-D elements		Validate using FEM software (Eg: Ansys)
Total in hours			**39**	**13**	**52**

5. Reference:

Sl. No.	**Description**
1	Schaum Outlines, "Strength of Materials", 5 Edition
2	RAMAMURTHAM. S., "Strength of Materials", 14th Edition, Dhanpat Rai Publications, 2011
3	KHURMI R S, "Applied Mechanics and Strength of Materials", 5 Edition, S.Chandand company
4	NASH W.A, "Theory and problems in Strength of Materials", Schaum Outline Series, McGraw-Hill Book Co., New York, 1995.
5	RYDER G.H, "Strength of Materials", 3rd Edition, Macmillan India Limited, 2002.
6	BANSAL R. K, "Strength of Materials", Laxmi Publications, New Delhi, 2012.
7	Schaum series, Strength of Materials
8	TIMOSHENKO S.P, "Elements of Strength of Materials", Tata McGraw-Hill, Delhi,
9	Introduction to Finite Elements in engineering by TRIRUPATHI R, CHANDRUPATLA, ASHOK D BELEGUNDA, Pearson Publications.
10	Practical Finite Element Analysis by NITIN S GOKHALE,SANJAY S DESHPANDE, Finite to Infinite Publications
11	ANSYS free software tutorial((Student version) https://www.google.co.in/search?biw=1024&bih= 667&q=ansys+software+ tutorial&sa=X&ved=0ah UKEwjm5o MndHNAh UBsI8KHbRWDhUQ1QIIXygE

6. LIST OF SOFTWARE/LEARNING WEBSITES

1. www.nptel.iitm.ac.in/courses/.../IIT.../lecture%2023%20and%2024htm
2. www.wikipedia.org/wiki/Shear_and_moment_diagram
3. www.freestudy.co.uk/mech%20prin%20h2/stress.pdf
4. www.engineerstudent.co.uk/stress_and_strain.html
5. www.**ansys**.com/Student
6. http://www.mece.ualberta.ca/tutorials/ansys

7. Equipment/software list

Sl. No.	Particulars	Specification	Quantity
01	Universal testing machine	Computerized 100 Ton Capacity With all attachments to conduct shear, bending , compression and tensile test	
02	Ansys software		
03	Desktop Computer	Latest configuration	

Machine Tool Technology

Subject Code -MEC302

1. Rationale: Diploma Engineers are responsible for supervising production processes to achieve production targets and for optimal utilization of resources. For this purpose, knowledge about various machining processes is required to be imparted. The students are to be trained and equipped with adequate theoretical and practical knowledge about Metal Cutting Phenomenon and various processes like turning, drilling, milling, grinding etc. Hence, this course is introduced to provide hands on experience on various machine tools used in the manufacturing stream and to provide foundation for diploma engineers who want to further specialise in the field of precision manufacturing

2. Course Outcomes: At the end of the Course, the student will be able to:

CO-01	List relevant work place Occupational health and safety standards and explain the importance of the need to comply with them.
CO-02	Explain the importance of Cutting tool Geometry, list various Cutting Parameters, the role and use of the right Coolants and Lubricants for the given machining processes.
CO-03	Demonstrate turning operation for a given component drawing and object, prepare a process chart and estimate the cost of its production as per drawing.
CO-04	Demonstrate milling and drilling operation needed as per a given component drawing, list all the machine tools needed for the operation, prepare a process chart and estimate the cost of its production as per the drawing.

3. Course Content

Week	CO	PO*	Lecture (Knowledge)	Tutorial (Activity)	Practice (Skill)
1	01	05	1. Educate about Safety standards Practiced in the machine Shop - Importance of housekeeping and good Shop floor Practices(5S) 2. Understand the Principles of First Aid. Preventive measures to be taken during Fire and Electrical emergency	Refer Table 1	1. Read and interpret the safety signs displayed in the Machine shop Instructor has to show various Safety sign charts and Personnel Protective Equipment (PPE) and ask the trainees to identify and record in the dairy 2. Read and interpret the PPE

			Types of Fire extinguisher (Class A,B,C,D) 3. Knowledge about Safety and Environment Regulations		First aid and basic training Identify and Segregate waste material (cotton waste, metal chips, burrs etc.) Arrangement of waste in bins 3. Hazards identification and avoidance Preventive measure for electrica accidents Select the fire extinguisher according to type of fire 4. Operate the Fire extinguisher and extinguish the fire Preventive measure for Oil leakages and related Hazards Practice the safety norms whil working on Deferent Machine Tool
2	02	01,04	1 Lubrication- Need of Lubrication- Selection of Lubricant as per ISO standard. 2. Theory of metal Removal- Traditional & Non Traditional material removal process- Chip forming & Non chip forming 3. Types of cutting tools- Single point tools-Multi point tools – Specification of Single Point Cutting Tool, Parting , Knurling Tool, V- tool	Refer Table 1	1. Instructor has to display all the Lubricants used in the section and brief about its uses 2. Select a Proper lubricant and demonstrate the lubrication of various m Ask the students to record in the Dairy 3. Instructor has to show all the tools, machineries and measuring instruments used in the machine shop and brief about its uses. Ask the students to record in the Dairy. 4. Identify the type of Chips formed and record in the dairy
3	02	01	1. Grinding- Abrasives- Applications of Natural abrasives- stand stone (Quartz), Corundum and Emery Diamond and Garnets- Application of Manufactured Abrasives- Silicon Carbide, Aluminum Oxide Cubic boron Nitride 2. Explain – Grit, Grade, Structure, Bond, Type ISO Designation of Grinding Wheels 3. Tool Geometry-Tool materials and Designation-Tool life & Wear	Refer Table 1	1. Practice on Grinding machine 2 Grinding Practice of Single point tool as per tool Geometry

			Concept of Cutting speed-Depth of cut-Feed		
4	03	01	1. Introduction to Surface Texture- Indication of Roughness Symbols- Complete surface symbol chart, Grade and Numbers,- Tolerances- Unilateral and Bilateral 2. Introduction to Lathe-Types of lathe- Capstone and Turret Lathe, Automatic Lathe and others - Specification of a Center Lathe -. Cutting Fluids- Selection of cutting fluids- 3. Explain Work holding Devices- Tool Holding Devices	Refer Table 1	1. Read and interpret the Surface finish and Tolerances in the given Production drawing. 2. Identify the main Parts of Lathe and its functions Identify the movements in Lathe Parts • Carriage • Cross Slide • Tail Stock 3. Remove the Chuck from Spindle Nose and again mount on it 4. Demonstration of holding Work piece in 3-Jaw and 4-Jaw chuck 5. Idle operation of Lathe. Rotation of spindle in Clockwise and Counter clockwise direction 6 .Identify the Lubrication Parts in Lathe 7. Set the Spindle speed - Feed -Lever Position.
5	03	01,02, 04	1. Explain Plain turning, Step turning, Knurling and Chamfering Operations 2. Prepare the Process plan as per the given drawing for Plain Turning, Step Turning, Knurling and Chamfering 2. Estimate the Production cost per Piece as per the given drawing for Plain Turning, Step Turning, Knurling and Chamfering (Consider all Direct and Indirect costs)	Refer Table 1	1. Read and Understand the given Drawing 2. Select the suitable Raw material 3. Fix the given material between headstock and Tail Stock after performing Facing and Countersinking. 4. Select the Speed and Feed 5. Select and set the appropriate cutting tools as per the sequence of operations 5 Perform all operations as per the process plan 6. Check the dimensions using measuring instruments 7. Observe and Identify the Chip Formation
6	03	01,02, 04	1. Explain Taper turning operations by different methods- Calculate Taper angles for	Refer Table 1	1. Read and Understand the given Drawing

			different Taper turning component Drawings 2. Prepare the Process plan as per the given drawing for Taper Turning 3. Estimate the Production cost per Piece as per the given drawing for Taper Turning(Consider all Direct and Indirect costs)		2. Mark the required dimensions as per the given drawing for Taper turning 3. Fix the given material between headstock and Tail Stock 4. Select and Set the tools to perform Taper turning 5. Select the Speed and Feed 6. Perform the Taper Turning operations and record the machining time. 7. Measure the Taper angle in the given specimen using Bevel Protractor
7	03	01,04	1. Explain Thread cutting Mechanism a) Half Nut Mechanism b) Tumbler Gear Mechanism 2. Prepare the Process plan as per the given drawing for Thread cutting 3. Estimate the Production cost per Piece as per the given drawing for Thread cutting (Consider all Direct and Indirect costs)	Refer Table 1	1. Read and Understand the given Drawing 2. Fix the given material between headstock and Tail Stock 3. Select and Set the tools to perform Thread cutting operations 4. Select the Speed ,Feed and lubricant 5. Perform the thread cutting operations Measure the Pitch of the thread for the given specimen by using Pitch Gauge
8	04	01,04	1. Introduction to Milling – Types of milling machine – Specification of a Milling machine 2. Types of Milling cutters and their uses- Milling Cutter Nomenclature- Specification of Milling Cutter 3. Methods of Milling-Up Milling and Down Milling- Work holding devices	Refer Table 1	1. Identification of Milling machine Parts and its Usage 2. Demonstrate the working Principle of Milling machine and movements of Table and Arbor 3. Setting of Vice and Job on the Table of Milling Machine 4. Set the Cutter on the Arbor 5. Illustrate the safety points to be observed while working on the Milling machine 6. Identify and Select the different Milling Cutters 7. Demonstrate the Up-milling and Down – Milling Process
9	04	01,02, 04	1. Explain Plain Milling Operation 2.. Prepare the Process plan as per the given drawing(Solid Block) for Plain Milling 3. Estimate the Production cost per Piece as per the given drawing for Plain Milling	Refer Table 1	1. Perform Plain Milling of Six faces of a Solid Block 2. Check the accuracy of the Job with suitable Measuring Instruments

			Operation (Consider all Direct and Indirect costs)		
10	04	01,02, 04,07	1. Explain Key way and V- slot Operation 2. Prepare the Process plan as per the given drawing for Key way and V- slot 3. Estimate the Production cost per Piece as per the given drawing for Key way and V-slot	Study the latest technological changes in this course and present the impact of these changes on industry	1. Perform Milling of Keyway and V Slot 2. Check the dimensional accuracy with suitable Measuring Instrument
11	04	01,02, 04,07	1. Explain Gear cutting by Indexing Methods 2. Prepare the Process plan as per the given drawing for Gear cutting 3. Estimate the Production cost per Piece as per the given drawing for Gear cutting		1. Demonstrate Indexing Head 2. Set and Align Indexing Head with reference to the Job on Milling machine Table 3. Perform Gear Teeth on a Blank by Simple Indexing Method

12	04	01,02, 04,07	1. Introduction to Drilling – Types of Drilling Machines- Specification of Drilling Machines-Specification of Drill Bit, Reamer , Die and Taps 2. Nomenclature of Drill Bit, Reamer, Die and Taps- Standard sizes of Drill Bits Explain Operations performed in Drilling Machines- Drilling, Counter sinking, Reaming, Boring, Tapping 3. Prepare the Process plan as per the given drawing and Estimate the Production cost per Piece as per the given drawing		1. Identification of Drilling machine Parts 2. Demonstrate the working Principle of Drilling machine 3. Set the Vice and Job on the Table of Drilling machine 4. Illustrate the safety points to be observed while working on the Drilling machine 5. Identify and Select the different Drill Bits 6. Set the Drill bits on the spindle. 7. Drill Equally spaced holes (Circular/Square/Rectangul ar plate) 8. Finish the pre-drilled hole with a Reamer
13	01, 02, 03, 04		Demonstrate the manufacturing of following components using YouTube Videos 1. Fasteners 2. Propeller Shaft 3. Gears 4. Piston manufacturing Discuss and Prepare a Report on the videos Presented for each manufactured component.		Demonstrate the manufacturing of following components using YouTube Videos 1. Tube and Piston Rod Manufacturing. 2. Cylinder manufacturing etc., 3. Single point tool 4. Drill bits Etc. Discuss and Prepare a Report on the videos Presented for each manufactured component
Total in hours			**39**	**13**	**52**

5. Reference:

Sl. No.	Description
1	Mechanical estimation and costing T.R.Banga and S.C.Sharma Khanna publishers
2	Mechanical Estimation Malhothra
3	Industrial Organization and Engineering Economics T.R. Banga and S.C.Sharma Khanna publishers
4	Mechanical Estimation NITTTR Chennai NITTTR Chennai
5	Mechanical costing and Estimation. Singh and Khan Khanna Publishers
6	Process Planning & Cost Estimation M.Adithan New age International
7	Rao, P.N., Manufacturing Technology, Vol I & II, Tata Mcgraw Hill Publishing Co., New Delhi, 1998
8	Seropekalpakjian, Steven R Schmid Manufacturing Engineering and Technology- Pearson Education-Delhi
9	Sharma, P.C., A Textbook Of Production Technology – Vol I And II, S. Chand & Company Ltd., New Delhi, 1996
10	HMT – "Production Technology", Tata Mcgraw-Hill, 1998

6. LIST OF SOFTWARES/ LEARNING WEBSITES:

1. http://calculatoredge.com/index.htm#mechanical
2. www.nptel.ac.in/courses/112105126/36
3. www.youtube.com/watch?v=T5gjkYvMg8A
4. www.youtube.com/watch?v=ESKoaZtoB1E
5. www.freevideolectures.com

7. Equipment list

Sl. No.	Particulars	Specification	Quantity
01	Center lathe With all accessories and attachments(Gear driven)	Max 50mm Dia Holding capacity 500mm Center distance .Swing over dia 200mm	
02	HSS cutting tool	20*20*150MM	
03	HSS cutting tool	10*10*150MM	
04	Cemented carbide tipped tools with holder brazed	For turning	
05	Knurling tool Rough	Standard	
06	Knurling tool Smooth	Standard	
07	Vernier calipers	300mm	
08	Outer caliper	5omm OD	
09	Steel scale	300mm	
10	Dial gauge for setting of work	Standard	
11	Counter sunk Drill Bit	6mm Taper shank	
12	Upright Drilling Machine	Upto 24mm drill With all attachment	

13	Sensitive Drilling Machine	Upto 18mm drill	
14	Machine Vice (To hold Job)	120mm Jaw Gap	
15	Drill Bit set	6mm to 24mm	
16	Marking Divider	200mm dia	
17	Marking punch	Standard	
18	Combination Set Square	Standard	
19	Surface plate	300*300mm	
20	Column and Knee type Vertical MILLING machine With all attachments	.Table Travel of 800mm .24mm cutters Bore dia (ID)	
21	Plain milling Cutter 24mm ID/Slab milling	Standard Size for Practice	
22	Key way cutter	6mm	
23	Key way cutter/Slot cutter	12	
24	Gear cutter (Spur teeth)	Standard Size for Practice	
25	Concave Milling cutter	Standard for Size Practice	
26	Convex Milling cutter	Standard Size for Practice	
27	Key way Milling cutter	40mm dia	
28	End Milling Cutter	24mm dia	
29	Bench Grinder	300mm wheel dia Rough and Smooth	

Manufacturing Processes

Subject Code -MEC303

1. Rationale: Diploma Engineers are responsible for supervising production processes to achieve production targets and for optimal utilization of resources. For this purpose, knowledge about various manufacturing processes is essential. This requires training the students in casting and metal forming domain so as to equip them with adequate theoretical and practical knowledge about the various metal casting and forming processes like rolling, forging, drawing, extrusion, Sheet metal work etc. Hence this course is introduced to provide hands on experience on various manufacturing processes.

2. Course Outcomes: At the end of the Course, the student will be able to

CO-01	Produce patterns, moulds, and casting of a given component drawing and estimate the cost of casting.
CO-02	Demonstrate forging operation for a given component drawing and estimate the cost of forging.
CO-03	Prepare sheet metal drawing, demonstrate sheet metal operation and estimate the costs of Sheet metal operation.
CO-04	Explain rolling and extrusion operation and list applications of metals forming processes.

3. Course Content

Week	CO	PO*	Lecture (Knowledge)	Tutorial (Activity)	Practice (Skill)
1	01	01,04	1. Introduction to foundry – You tube videos on foundries Explain the safety Precautions to be taken in foundries 2. Explain the need of a Pattern- Types of Patterns—Solid or Single Piece pattern, Split Pattern, Loose Piece Pattern, Match Plate Pattern, Gated Pattern, Sweep Pattern, Skeleton-Pattern 3. Allowances- Materials used for Pattern	Refer Table 1	1. Identify the tools and equipment used in foundry with application 2. Prepare a single Piece wooden Pattern considering all allowances
2	01	01,04	1. Molding Sand-Types 2. Ingredients and Properties of Molding Sand	Refer Table 1	1. Prepare a molding sand 2. Preparation of Mold with the help of Pattern

			3. Importance of Core and Core prints-Gates-Runner-Riser		3. Melt the metal (wax) and pouring it into the mold cavity
3	01	01,04	1. Explain Defects in Casting 2. Inspection of Casting 3. Determination of Production Cost of a given material considering Raw material, Process cost, Overheads and other expenses	Refer Table 1	1. Cutting Runner and riser in the casted component 2. Cleaning of the casted component 3. Inspection of the casted component 4. Record the defects, if any
4	02	01,04	1. Introduction to basic Metal Forming Process and Applications- Show You tube Video's on Metal Forming Process 2. Explain Hot and Cold Working Process with Application Show You tube Videos on Hot and Cold Working Process 3. Introduction to forging operation- Types of forging- Hand forging and Power forging	Refer Table 1	1. Demonstrate safety precautions to be followed in Forging 2. Identify the tools and equipment's used in forging 3. Forging Practice (Hammering)
5	02	01,04	1. Explain forging Operations - Upsetting, drawing down, Cutting, Bending 2. Explain Punching and Drifting, Setting down and Finishing, Forge Welding 3 Estimation of Length of Raw material required to convert Circular rod to Square and Calculate the Production Cost considering direct and Indirect expenses.	Refer Table 1	Conversion of Circular rod to Square
6	02	01,04	1. Estimation of Length of Raw material required to convert Circular rod to Hexagon and Calculate the Production Cost considering direct and Indirect expenses. 2. Explain the working principle of Power hammer 3. Show the you tube videos on components produced by Power forging	Refer Table 1	Conversion of Circular rod to Hexagon
7	02	01,04	1. Estimation of Length of Raw material required to convert Hexagon to" L" shaped Nail and Calculate the Production Cost considering direct and Indirect expenses 2. Explain Forging losses- Forging Defects	Refer Table 1	Conversion of Hexagon to " L" Nail as per the given drawing

			3. Show the you tube videos on components produced by forging operations		
8	03	01,04	1. Introduction to sheet metal- Show You tube videos on sheet metal operations and Applications 2. Explain sheet metal materials – Standard Gauges of sheet - Specification of Sheet 3. Explain different Sheet metal operations	Refer Table 1	1. Identify and demonstrate the various tools used for sheet metal operations. 2. Measure the gauges of sheet 3. Demonstrate the operations performed on Shearing machine
9	03	01,04	1. Explain the Development of Cone and Cylinder 2. Explain the Development of Prism and Pyramid 3. Explain the Development of Funnel	Refer Table 1	1. Prepare Cone, Cylinder, Prism, Pyramid and Funnel 2. Join end surfaces by means of Seam Joint
10	03	01,04	1. Explain the Development of Tray 2. Explain the Development of Transition pieces 3. Explain the Development of Transition pieces	Refer Table 1	1. Prepare a Tray 2. Prepare any Transition Piece
11	03	01,04 07	1. Find the total Production cost of a sheet metal components like Open container, Cylindrical Drum 2. Introduction to Power Press -Press size- Press tools – Die Accessories 3. Types of Die and its operations	Study the latest technological changes in this course and present the impact of these changes on industry	1. Present You tube Videos on Press work operations 2. Record the observations made and prepare a report.
12	04	01,07	1. Introduction to Rolling- Nomenclature of Rolled Products- Dies used in rolling process 2. Types of Rolling mills-2 high mill- 3 High mill – 4 High mill- Cluster mill, Tandem Mill, Planetary mill, Defects in Rolling 3. Introduction to Extrusion and Drawing – Types of Extrusion Process. Wire and Tube Drawing Process, Dies used in Extrusion and Drawing Process		Video/ Virtual exposure on Rolling and Extrusion
13	04	01,07	Demonstrate the manufacturing of following components using YouTube Videos 1. Crank Shaft 2. Valves 3. Wheel 4. Gear case 5. Hair springs		Demonstrate the manufacturing of following components using YouTube Videos 1. TMT Steels 2. Channel sections 3. Pump Casings 4. Rolling of Sheets

			Discuss and Prepare a Report on the videos Presented for each manufactured component		5. Tooth paste tube 6. Pipes 7. Tubes etc., Discuss and Prepare a Report on the videos Presented for each manufactured component
Total in hours			**39**	**13**	**52**

Reference:

Sl. No.	Description
1	Elements of Workshop Technology (Vols. 1 and II) by Hajra Chaudhary
2	Production Technology By R.K. Jain
3	Foundry Technology By O.P.Khanna
4	Engineering Drawing Vol-2 By K.R.Gopala Krishna
5	Engineering Drawing By N.D.Bhat

Equipment list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
01	Moulding box	300*300*100mm	
02	Moulding Rammer	Standard size	
03	Moulding tool kit	Standard size	
04	Electric furnace for melting (Wax/Low melting point metal with crucible and ladder for pouring)	Standard size	
05	Portable grinder for cleaning of casting	Standard size	
06	Sand Blaster	Standard size	
07	Ball peen Hammer	½ lb	
08	Pattern Making Tool kit	Standard size	
09	Anvil For Forging	Standard size	
10	Sledge hammer	2 LB	
11	Hand hammer	1 lb	
12	Flatteners	Standard size	
13	Flat Tongs	Standard size	
14	Round Tongs	Standard size	
15	Steel scale	300mm	
16	G I Bucket for Quenching	15 lts capacity	
17	Open Heart Furnace with stand and Blower	Standard size	
18	Hot Chisel	24mm size	
19	Sheet shearing Machine(Manual or M/c type)	Standard size	
20	Sniper for cutting sheet	Standard size	
21	Metal stake	Standard size	
22	Wooden mallet	Standard size	
23	Plastic Hammer	Standard size	
24	Bench vice for Bending of sheet	Standard size	
25	Brazing Gun	Standard size	

Fluid Power Engineering

Subject Code -MEC304

1. Rationale: Fluid power is one of the basic building blocks of modern automation and is most widely used system to convert fluid energy into useful work through the use of pump, compressor, control valves, actuators and other controlling elements. This technology is used to power a range of items such as tools, construction equipment and machineries, automotive and machineries in manufacturing sectors. Fluid power engineering involves study of properties of fluids, laws governing flow of fluids, working principles of fluid machineries and knowledge of control of machine movements. This course allows the students to develop the knowledge and understanding of the operational requirements of fluid power system and be able to recognise circuit components and build the circuits for applications needed in daily life

2. Course Outcomes: At the end of this course, student will be able to

CO-01	Measure fluid discharge through Channels and Pipes using instruments and estimate the size of the pipe needed for a given population size.
CO-02	Select the right hydraulic machinery to be used in a specific application for a given head and discharge.
CO-03	List the various components and its use in a given fluid power system.
CO-04	Build a simple fluid power system for a given application

3. Course Content

Week	CO	PO*	Lecture (Knowledge)	Tutorial (Activity)	Practice (Skill)
1	01	01,04	1. Explain classification and Properties of fluids- Units- Conversion of Cubic meters- Liters – Gallons -TMC 2. Explain Pascal Law, Equation of continuity, Concept of Total Energy 3. Explain Bernoulli's equation and its Applications- Venturi meter, Pitot tube, Orifice meter	Ref Table 1	1. Find Discharge of a fluid through Venturimeter
2	01	01,04	1. Explain Discharge through Rectangular Notch -Numerical Problems 2. Explain Discharge through V- notch - Numerical Problem 3. Explain Flow through Pipes- Major and Minor Losses	Ref Table 1	1. Finding Discharge through Rectangular Notch 2. Finding Discharge through V- Notch

3	01	01,04	1. Determine co-efficient of friction by using Chezy's and Darcy's formulae 2. Design a Pipe for a given number of Inhabitants 3. Design a Pipe for a given discharge	Ref Table 1	1. Finding Co-efficient of Friction in Pipes 2. You tube presentation on fluid flow through pipes and notches
4	02	01,02,04	1. Classification of Pumps 2. Explain the Working Principle of Centrifugal Pump and its Application 3. Explain the Working Principle of Monoblock and its Application	Ref Table 1	1. Find the discharge through Centrifugal Pump 2. Servicing and Repair of Centrifugal Pumps
5	03	01,02,04	1. Explain the Working Principle of Submersible pump and its application 2. Explain the Working Principle of Reciprocating pump and its application 3. Select a suitable Pump for a given Application	Ref Table 1	Servicing and Repair of Submersible pumps
6	02	01,04	1. Classification of Hydraulic Turbines 2. Select a suitable Turbine for a given Head 3. Explain the Working Principle of Impulse Turbine and its Application	Ref Table 1	Determine Performance of Pelton wheel
7	02	01	1. Explain the Working Principle of Reaction Turbine and its Application 2. Explain the Importance of Draft tube, Penstock and Surge Tank 3. Video on Hydraulic Power Plant	Ref Table 1	Video on fluid flow from source to End application Eg: Oil Refineries, Hydraulic Power plant, Water distribution through pipe lines
8	03	01	Identify the basic components of Fluid power Systems with Symbols and Application • Air compressor • Air Drier • FRL Unit • Gear Pump • Pressure control Valve- Pressure Reducing Valve, Pressure Intensifier • Direction control Valves - 3/2 , 5/2, 4/2 • Flow control Valve • Needle Valve • Check Valve • Shuttle Valve • Quick Exhaust Valve • Time Delay Valve	Ref Table 1	Video on Working principles of components used in Fluid Power Systems
9	03	01	• Explain Valve Actuating mechanisms - Spring, Lever, Push button, Solenoid • Explain the role of Accumulators in fluid power systems. • Explain working principle of Actuators- Single Acting, Double acting Air Cylinders, Air Motors	Ref Table 1	Video on Working principles of components used in Fluid Power Systems

			• Explain the importance of Seals and Packages		
10	04	01,04	• Build a Fluid Power circuit to Control Speed of a Single Acting cylinder • Build a Fluid Power circuit to Control Speed of a Double Acting cylinder • Build a Fluid Power circuit for Pilot control Double Acting Cylinder	Ref Table 1	Execute the circuit Practiced in the Class using Trainer Kit or Simulation Software
11	04	01,04,07	• Build a Fluid Power circuit for double Acting Cylinder being controlled by 4/2 DC Solenoid Operated Valve • Build a Circuit for Stamping operation by using 3/2 DC Valve with Single Acting Cylinder • Build a Circuit for Automatic Opening and Closing of Door by /using double Acting Cylinder being controlled by 4/2 DC Valve	Study the latest technological changes in this course and present the impact of these changes on industry	Execute minimum 2 Circuits Practiced in the Class using Trainer Kit or Simulation Software
12	04	01,03,07	• Build a Fluid Power circuit for Automatic reciprocating motion of a double acting Cylinder • Build a circuit for feeding a strip with following sequences: Holding the strip, moving the strip forward on to the tool, maintaining the strip in that position and returning the strip to its original position after work is over. • Design a Circuit to press fit a pin to a hole with a precondition that while actuating of the cylinder, both the hands of the operator should be engaged		Execute minimum 2 Circuits Practiced in the Class using Trainer Kit or Simulation Software
13	04	01,07	• Build Circuit for a machine device driven by a single acting cylinder with actuation at least two mutually operated DC valves (Safety circuit with OR and AND Gates) • Build Circuit for the Clamping Device of a Drilling Machine of a Drilling machine such that the clamps are activated before the drill is fed to the Work • Build a Circuit for your Own Application		Execute minimum 2 Circuits Practiced in the Class using Trainer Kit or Simulation Software, including developing your Own Pneumatic Circuit to perform certain function

Total in hours	**39**	**13**	**52**

Reference:

Sl. No.	Description
1	Bansal. R.K.,"Fluid Mechanics and Hydraulics Machines", 9th Edition, Laxmi Publications Private Limited, New Delhi. 2011.
2	R.S.Khurmi, "Fluid Mechanics and Machinery",S.Chand and Company, 2nd Edition, 2007.
3	Hydraulics & Pneumatics – Andrew Parr, Jaico Publishing House New Delhi.
4	Hydraulic and Pneumatic Controls Understanding Made Easy- K.S.Sundaram,- S.chand Company Delhi
5	Ramamrutham. S, "Fluid Mechanics, Hydraulics and Fluid Machines", Dhanpat Rai & Sons, Delhi, 2004.
6	P. N Modi and S. M. Seth, "Hydraulics and Fluid Mechanics Including Hydraulics Machines", 19th Edition, Standard Book House, 2013
7	Hydraulic and Pneumatic Controls- Srinivasan, R.- Vijay Nicole Imprints Private Limited, 2/e, 2008
8	Pneumatic And Pneumatics Controls -Understanding Made Easy - K.S.Sundaram,-S.chand Company Delhi
9	Pneumatic Systems - Majumdar, S.R. -Tata McGraw-Hill Publication, 3/e, 2013

5. LIST OF SOFTWARES/ LEARNING WEBSITES:

1. www.youtube.com/watch?v=VyR8aeioQrU
2. http://www.youtube.com/watch?v=R6_q5gxf4vs
3. www.howstuffworks.com
4. . http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-_KANPUR/machine/ui/TOC.htm
5. https://www.youtube.com/watch?v=F_7OhKUYV5c&list=PLE17B519F3ACF9376
6. https://www.youtube.com/watch?v=zOJ6gWDMTfE&list=PLC242EBB626D5FFB5
7. http://www.youtube.com/watch?v=0p03UTgpnDU
8. http://www.youtube.com/watch?v=A3ormYVZMXE
9. http://www.youtube.com/watch?v=TjzKpke0nSU
10. http://www.youtube.com/watch?v=vl7GteLxgdQ

11. http://www.youtube.com/watch?v=cIdMNOysMGI
12. www.boschrexroth.co.in
13. http://www.automationstudio.com/
14. http://www.howstuffworks.com/search.php?terms=hydraulics
15. http://hyperphysics.phy-astr.gsu.edu/hbase/fluid.html#flucon
16. http://www.youtube.com/watch?v=FVR7AC8ExIM
17. http://www.youtube.com/watch?v=iOXRoYHdCV0
18. http://www.youtube.com/watch?v=qDinpuq4T0U
19. http://www.youtube.com/watch?v=xxoAm3X4iw0
20. www.festo.com
21. www.boschrexroth.co.in
22. www.nptel.iitm.ac.in

23 .http://www.howstuffworks.com/search.php?terms=pneumatics

Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
01	Bench mounted Test Rig for Venturi meter	----------	
02	Bench mounted Test Rig for Notches	……	
03	Bench mounted Test Rig for Friction through pipes	……..	
04	Centrifugal Pumps FOR Maintaines and Servicing	Used one	
05	Mano block Pumps FOR Maintenance and Servicing	……do…….	
06	Submersible Pumps FOR Maintenance and Servicing	……do……	
07	Pneumatics Trainer Kit with all standard accessories.	Standard size	
08	Compressor for Pneumatics Trainer Kit	6 Bar pressure Single phase 50 Hz	
09	Hose pipes for Pneumatics Trainer Kit	……..	
10	Bench mounted Test Rig for Pelton wheel	Standard size	