Government of Karnataka

DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Curriculum Structure

III Semester Scheme of Studies- Diploma in Mechanical Engineering

Sl. No.	Course Category / Teaching Department	Course Code	Course Name	Hours per week			Total contact hrs /week	Credits	CIE Marks		SEE Marks		Total Marks	Min Marks for Passing (including CIE marks)	Assigned Grade	Grade Point	SGPA and CGPA
				L	T	P			Max	Min	Max	Min					
Integrated Courses																	Both SGPA & CGPA
1	PC/ME	20ME31P	Mechanics of Materials	3	1	4	8	6	60	24	40	16	100	40			
2	PC/ME	20ME32P	Machine Tool Technology	3	1	4	8	6	60	24	40	16	100	40			
3	PC/ME	20ME33P	Manufacturing Processes	3	1	4	8	6	60	24	40	16	100	40			
4	PC/ME	20ME34P	Fluid Power Engineering	3	1	4	8	6	60	24	40	16	100	40			
Audit Course																	
5	AU/KA	20KA31T	ಸಾಹಿತ್ಯ ಸಿಂಚನ-II/ ಬಳಕೆ ಕನ್ನಡ-II	2	0	0	2	2	50	20	-	-	50	20			
Total				**14**	**4**	**16**	**34**	**26**	**290**	**116**	**160**	**64**	**450**	**180**			

PC: Programme Core:: AU-Audit Course:: KA: Kannada:: L: Lecture:: T: Tutorial:: P: Practice

Government of Karnataka
DEPARTMENT OF TECHNICAL EDUCATION

Programme	Mechanical Engineering	**Semester**	III
Course Code	20ME31P	**Type of Course**	Programme Core
Course Name	**Mechanics of Materials**	**Contact Hours**	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P :: 3:1:4	**Credits**	6
CIE Marks	60	**SEE Marks**	40

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)
			3 hours/week	1 hour/week	4 hours/week (2 hours/batch twice in a week)
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**

- ***PO= Program Outcome as listed and defined in year 1 curriculum**
- **Course Coordinator must prepare PO – CO mapping with strength (Low/Medium/High) before course planning**

TABLE 1: Suggestive Activities for Tutorials: (The List is only shared as an Example and not inclusive of all possible activities of the course. Student and Faculty are encouraged to choose activities that are relevant to the topic and on the availability of such resources at their institution).

Sl. No.	Suggestive Activities for Tutorials
01	Understand Static Equilibrium using common examples, try to apply the principles and demonstrate in class the importance of static equilibrium in daily life, at home or at work.
02	Study the behavior of Aluminum under the action of Tensile/Compression Load. Plot Stress Strain Diagram and Demonstrate in the class the behavior of Aluminum different from that of a Cast Iron.
03	A seesaw is occupied by two children of equal weight "W" N. The center of gravity of each child is x meters from the fulcrum. The length of the board is 3x meters, y mm wide and z mm thick. Determine the maximum bending stress and shear stress in the board.
04	Tapered elastic bar subjected to an applied tensile load P at one end and attached to a fixed support at the other end. The cross-sectional area varies linearly from A_0 at the fixed support at x = 0 to $A_0/2$ at x = L. Calculate the displacement of the end of the bar (a) by modelling the bar as a single element having cross-sectional area equal to the area of the actual bar at its midpoint along the length, (b) using two bar elements of equal length and similarly evaluating the area at the midpoint of each, and compare to the exact solution By FEM.
05	Identify the type Beam in Traffic Light Post. Determine the displacement field for this beam subjected to UDL throughout its length.
06	Discuss procedure using the commercial package available today for solving problems of FEM. Take a Structural Problem to Demonstrate the same.
07	In 1989, Jason, a research-type submersible with remote TV monitoring capabilities and weighing 35 200 N, was lowered to a depth of 646 m in an effort to send back to the attending surface vessel photographs of a sunken Roman ship offshore from Italy. The submersible was lowered at the end of a hollow steel cable having an area of 452 × 10–6 m^2 and E = 200 GPa. Determine the extension of the steel cable. Due to the small volume of the entire system, buoyancy may be neglected.
08	Laboratory tests on human teeth indicate that the area effective during chewing is approximately 0.25 cm^2 and that the tooth length is about 1.1 cm. If the applied load in the vertical direction is 880 N and the measured shortening is 0.004 cm, determine Young's modulus.

4. CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill test reduced to 20
5	CIE-5 Skill Test-Practice	12	180	100	
6	CIE-6 Portfolio continuous evaluation of Tutorial sessions through Rubrics	1-13		10	10
Total CIE Marks					60
Semester End Examination (Practice)			180	100	40
Total Marks					**100**

5. Format for CIE written Test

Course Name	**Mechanics of Materials**	Test	I/II/III	Sem	III
Course Code	20ME31P	Duration	80 Min	Marks	30

Note: Answer any one full question from each section. Each full question carries 10 marks.

Section	Assessment Questions	Cognitive Levels(R/U/A)	Course Outcome	Marks
I	1			
	2			
II	3			
	4			
III	5			
	6			

Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, cognitive level and course outcomes.

5. (a) For CIE Skill Test -4 **Duration :240Min**

SL. No.	CO	Particulars/Dimension	Marks
1	01	Verification of Forces by Lami's Theorem • Finding the resultant of forces - Analytical Method –15 Marks • Verification of Forces by Lami's Theorem – Practically-15Marks	30
2	02	Determine the deformation of a given specimen subjected to Tensile/Compressive/Shear loads/Bending using UTM • Writing observations and Tabular column -- 10 Marks • Writing Equations required With all notations –- 10 Marks • Conduction of Experiment --- 20 Marks • Calculation and Result with Graph if any --- 20 Marks	60
3	01,02	**Portfolio evaluation based on the average of all Practice Sessions (1-6 weeks)**	**10**
Total Marks			**100**

5.(b)For CIE Skill Test -5 **Duration :240Min**

SL. No.	CO	Particulars/Dimension	Marks
1	02	Calculate and Plot SFD and BMD for the Given Data • Finding Shear force and Bending Moment – (10+15)=25 Marks • Plot SFD and BMD – 15 Marks	40
2	03,04	Apply finite element formulations to solve the given One dimensional cases and Validate using Ansys • Solve by FEM Method —25 Marks • Validate Using FEM software (Eg: Ansys) ---25 Marks	50
3	02,03, 04	**Portfolio evaluation based on the average of all Practice Sessions (7-12 weeks)**	**10**
Total Marks			**100**

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
	Average Marks= (8+6+2+2)/4=4.5						**5**

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. 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

8. 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

9. SEE Scheme of Evaluation **Duration: 180 Min**

SL. No.	CO	Particulars/Dimension	Marks
1	01,02	Determine the deformation of a given specimen subjected to Tensile/Compressive/Shear loads using UTM • Writing observations and Tabular column -- 10 Marks • Writing Equations required With all notations -- 10 Marks • Conduction of Experiment --- 05 Marks • Calculation and Result with Graph if any --- 15 Marks **OR** Calculate and Plot SFD and BMD for the Given Data • Finding Shear force and Bending Moment – 10 Marks • Plot SFD and BMD – 15 Marks • Validate Using FEM software (Eg: Ansys) ---15 Marks	**40**

2	03 , 04	Apply finite element formulations to solve the given One dimensional /Two dimensional cases and Validate using Ansys • Solve by FEM Method —20Marks • Validate FEM software (Eg: Ansys)---20 Marks	**40**
3	01,02,03 ,04	Viva voce	**20**
Total Marks			**100**

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

Sl. No.	Particulars	Specification	Quantity
01	Universal testing machine	Computerized 100 Ton Capacity With all attachments to conduct shear, bending , compression and tensile test	01
02	Ansys software		20 user
03	Desktop Computer	Latest configuration	10 nos

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DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Programme	Mechanical Engineering	**Semester**	III
Course Code	20ME32P	**Type of Course**	Programme Core
Course Name	**Machine Tool Technology**	**Contact Hours**	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P :: 3:1:4	**Credits**	6
CIE Marks	60	**SEE Marks**	40

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)**
			3 hours/week	1 hour/week	4 hours/week (2 hours/batch twice in a week)
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 while 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/Rectangular 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**

- ***PO= Program Outcome as listed and defined in year 1 curriculum**
- **Course Coordinator must prepare PO – CO mapping with strength (Low/Medium/High) before course planning**

Table 1: Suggestive Activities for Tutorials: (The List is only shared as an Example and not inclusive of all possible activities of the course. Student and Faculty are encouraged to choose activities that are relevant to the topic and on the availability of such resources at their institution)

Sl.No.	Suggestive Activities for Tutorials
01	Present a report on Machine safety Guidelines as per the Applicable standard Guide lines (CSA Standard Z 432-04 (R 2009)) including hazards associated with machines , Power tools, Machine Shop. Also Discuss general controls for reducing machine Hazards. https://ehs.utoronto.ca

02	Discuss Common grinding Problems And their Remedies. Also discuss the need for Balancing the Grinding Wheels.. https://www.Euromarcconz
03	Whether it's granite for your countertops, backsplash, or floor tiles, making pristine cuts can be achieved with proper precautions, techniques, and specialized granite cutting tools for making tiles and slabs of this hard rock. Discuss and present a report on those tools.
04	Present a Report on Applications of Inversions of Kinematic Mechanisms: With-worth quick return motion mechanism in Shaper Double-slider crank mechanism
05	Present a Case Study on Machine tool chatter arising in an interrupted turning process https://core.ac.uk/download/pdf/33663698.pdf
06	Present a Report on Influence of Cutting Parameters on cutting force and Surface finish in Turning operation https://www.sciencedirect.com
07	Analyse tolerances in a Production Drawing
08	Analyse Surface finish symbols in a Production Drawing
09	Demonstrate the various measuring instruments used in Machine Shop
10	Collect the sample piece of various raw materials used in machine shop and Discuss their mechanical, chemical and Physical properties

4. CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill test reduced to 20
5	CIE-5 Skill Test-Practice	12	180	100	
6	CIE-6 Portfolio continuous evaluation of Tutorial sessions through Rubrics	1-13		10	10
				Total CIE Marks	60
	Semester End Examination (Practice)		180	100	40
				Total Marks	**100**

5. Format for CIE written Test

Course Name	**Machine Tool Technology**	Test	I/II/III	Sem	III
Course Code	20ME32P	Duration	80 Min	Marks	30

Note: Answer any one full question from each section. Each full question carries 10 marks.

Section	Assessment Questions	Cognitive Levels(R/U/A)	Course Outcome	Marks
I	1			
	2			
II	3			
	4			
III	5			

	6			
Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.				

5 . (a) For CIE Skill Test -4 **Duration: 240Min**

SL. No.	CO	Particulars/Dimension	Marks
1	**03**	**Question on Turning operations with Process plan, Production Cost of the product for a Given parameters** • Process plan includes Component Drawing ,process list and Tool selection=25marks • Costing includes Raw material ,process and finding Total cost , selling Price and cost of scrap =25marks • Performance of Turning and Taper turning operations(20+15)=35 marks • Dimensional accuracy=05 Marks	**90**
2	**01,02,03**	**Portfolio evaluation based on the average of all Practice Sessions (1-6 weeks)**	**10**
Total Marks			**100**

5. (b) For CIE Skill Test -5 **Duration: 240 Min**

SL. No.	CO	Particulars/Dimension	Marks
1	**04**	**Question on Milling operations with Process plan and Production Cost of the product for a Given parameters** • Process plan includes Component Drawing , process list and Tool selection= 20marks • Costing includes Raw material ,process and finding Total cost , selling Price and cost of scrap = 30marks • Performance of Milling operations including Key/Slot/Gear teeth cutting operations (20+15)= 35 marks • Dimensional accuracy=05 Marks	**90**
2	**03,04**	**Portfolio evaluation based on the average of all Practice Sessions (7-12 Weeks)**	**10**
Total Marks			**100**

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
	Average Marks= (8+6+2+2)/4=4.5						**5**

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. 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

8. 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

9. SEE Scheme of Evaluation **Duration: 180min**

SL. No.	CO	Particulars/Dimension	Marks
1	03,04	**Question on Turning operations with Process plan and Production Cost of the product for a Given parameters** • Process plan includes Component Drawing, process list and Tool selection= 20marks • Costing includes Raw material ,process and finding Total cost , selling Price and cost of scrap =25 marks • Performance of Operations =30marks • Dimensional accuracy=05 Marks **OR** **Question on Milling operations with Process plan and Production Cost of the product for a Given parameters** • Process plan includes Component Drawing, process list and Tool selection= 20marks • Costing includes Raw material, process and finding Total cost , selling Price and cost of scrap = 25marks • Performance of Milling operations including Key/Slot/Gear teeth cutting operations (20+10)= 30 marks • Dimensional accuracy=05 Marks	**80**
2	01,02, 03,04	Viva voce	**20**
	Total Marks		**100**

10. Equipment list with Specification for a batch of 20 students

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	20
02	HSS cutting tool	20*20*150MM	40
03	HSS cutting tool	10*10*150MM	20
04	Cemented carbide tipped tools with holder brazed	For turning	20
05	Knurling tool Rough	Standard	10
06	Knurling tool Smooth	Standard	10
07	Vernier calipers	300mm	20
08	Outer caliper	5omm OD	20
09	Steel scale	300mm	20
10	Dial gauge for setting of work	Standard	10
11	Counter sunk Drill Bit	6mm Taper shank	20
12	Upright Drilling Machine	Upto 24mm drill With all attachment	01
13	Sensitive Drilling Machine	Upto 18mm drill	01
14	Machine Vice (To hold Job)	120mm Jaw Gap	05
15	Drill Bit set	6mm to 24mm	10 set
16	Marking Divider	200mm dia	
17	Marking punch	Standard	20nos
18	Combination Set Square	Standard	10 nos
19	Surface plate	300*300mm	01 no
20	Column and Knee type Vertical MILLING machine With all attachments	.Table Travel of 800mm .24mm cutters Bore dia (ID)	01no
21	Plain milling Cutter 24mm ID/Slab milling	Standard Size for Practice	05
22	Key way cutter	6mm	10
23	Key way cutter/Slot cutter	12	10
24	Gear cutter (Spur teeth)	Standard Size for Practice	10
25	Concave Milling cutter	Standard for Size Practice	10
26	Convex Milling cutter	Standard Size for Practice	10
27	Key way Milling cutter	40mm dia	10
28	End Milling Cutter	24mm dia	10
29	Bench Grinder	300mm wheel dia Rough and Smooth	02

Government of Karnataka
DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Programme	Mechanical Engineering	**Semester**	III
Course Code	20ME33P	**Type of Course**	Programme Core
Course Name	**Manufacturing Processes**	**Contact Hours**	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P :: 3:1:4	**Credits**	6
CIE Marks	60	**SEE Marks**	40

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)**
			3 hours/week	1 hour/week	4 hours/week (2 hours/batch twice in a week)
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**

- ***PO= Program Outcome as listed and defined in year 1 curriculum**
- **Course Coordinator must prepare PO – CO mapping with strength (Low/Medium/High) before course planning**

Table 1: Suggestive Activities for Tutorials: (The List is only shared as an Example and not inclusive of all possible activities of the course. Student and Faculty are encouraged to choose activities that are relevant to the topic and on the availability of such resources at their institution)

Sl.No.	Suggestive Activities for Tutorials
01	From heavy casting of 300Kg to small casting of 30 kg, investment casting method is used for as wide for hi-tech industrial applications. Investment casting is largely relied on for complicated designs that cannot be casted using any other method. Discuss. Also, Present the Preparation of Patterns for the Process. Compare the relative surface finish of this process with other Casting Processes.
02	Discuss the forging defects commonly occurring in forgings, their causes and Remedies. Present the methodology for measuring Forging defects. https:// studentlesson.com
03	A Gas cylinder is produced by Sheet metal operations. Prepare the development and Present the procedure involved in making the given component.
04	Identify the forming process adopted in making Tooth Paste Tubes. Present the process. List the limitations involved and solutions to overcome these limitations.
05	Estimation of Length of Raw material required for a forged bolt and Calculate the Production Cost considering direct and Indirect expenses.

4. CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill test reduced to 20
5	CIE-5 Skill Test-Practice	12	180	100	
6	CIE-6 Portfolio continuous evaluation of Tutorial sessions through Rubrics	1-13		10	10
				Total CIE Marks	60
	Semester End Examination (Practice)		180	100	40
				Total Marks	**100**

5. Format for CIE written Test

Course Name	Manufacturing Processes	Test	I/II/III	Sem	III/IV
Course Code	20ME33P	Duration	80 Min	Marks	30
Note: Answer any one full question from each section. Each full question carries 10 marks.					
Section	Assessment Questions		Cognitive Levels	Course Outcome	Marks

I	1			
	2			
II	3			
	4			
III	5			
	6			
Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.				

5. (a) For CIE Skill Test - 4 **Duration :240 Min**

SL. No.	CO	Particulars/Dimension	Marks
1	01	Question on Casting Process With Process plan, Costing of the product for a Given parameters including pattern, melting and other expenses • Process plan including Component Drawing ,process list and Tool/Equipment's selection= 15 marks • Preparation of Mold by using Pattern=25 Marks • Costing including Raw material ,process and finding Total cost , selling Price =25 Marks • Operation performed =20 marks • Dimensional accuracy = 05 Marks	90
2	01	Portfolio evaluation based on the average of all Practice Sessions (1-6 weeks)	10
Total Marks			**100**

5. (b) For CIE Skill Test -5 **Duration :240 Min**

SL. No.	CO	Particulars/Dimension	Marks
1	02	Question on Forging operation with Process plan, Calculation of Raw material Length, Costing of the product for a Given parameters considering all Possible Losses. • Process plan including Component Drawing ,process list and Tool/Equipment's selection= 15 marks • Costing including Raw material length ,process time and finding Total cost , selling Price = 25 marks • Operations Performed with Dimensional accuracy= 20Marks.	60
2	03	One Skill oriented Question on Sheet Metal work • Development for a given drawing =20 Marks • Sheet metal Operation with Dimensional accuracy =10 marks	30
3	02,03	Portfolio evaluation based on the average of all Practice Sessions (7-12 weeks)	10
Total Marks			**100**

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6

3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
	Average Marks= (8+6+2+2)/4=4.5						**5**

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. 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

8. SEE Scheme of Evaluation **Duration :180 Min**

SL. No.	CO	Particulars/Dimension	Marks
1	01,02	One Skill oriented Question on Casting • Process plan including Component Drawing ,process list and Tool/Equipment's selection= 15 marks • Preparation of Mold by using Pattern=30Marks • Other Operations performed =10 marks **OR** One Skill oriented Question on Forging operation with Process plan, Calculation of Raw material Length, Costing of the product for the Given parameters considering all Possible Losses. • Process plan including Component Drawing ,process list and Tool/Equipment's selection= 20 marks • Costing including Raw material length ,process time and finding Total cost , selling Price =25marks • Operations Performed with Dimensional accuracy=10 Marks.	55
2	03	One Skill oriented Question on Sheet Metal work • Development of product=15 Marks • Performance and Operation with Dimensional accuracy =10 marks	25
4	01,02,03,04	Viva voce	20
		Total Marks	**100**

9. Equipment list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
01	Moulding box	300*300*100mm	20
02	Moulding Rammer	Standard size	20
03	Moulding tool kit	Standard size	20
04	Electric furnace for melting (Wax/Low melting point metal with crucible and ladder for pouring)	Standard size	04
05	Portable grinder for cleaning of casting	Standard size	02
06	Sand Blaster	Standard size	04
07	Ball peen Hammer	½ lb	05
08	Pattern Making Tool kit	Standard size	10
09	Anvil For Forging	Standard size	05
10	Sledge hammer	2 LB	10

11	Hand hammer	1 lb	10
12	Flatteners	Standard size	20
13	Flat Tongs	Standard size	20
14	Round Tongs	Standard size	20
15	Steel scale	300mm	20
16	G I Bucket for Quenching	15 lts capacity	10
17	Open Heart Furnace with stand and Blower	Standard size	04
18	Hot Chisel	24mm size	10
19	Sheet shearing Machine(Manual or M/c type)	Standard size	04
20	Sniper for cutting sheet	Standard size	20
21	Metal stake	Standard size	10
22	Wooden mallet	Standard size	20
23	Plastic Hammer	Standard size	20
24	Bench vice for Bending of sheet	Standard size	05
25	Brazing Gun	Standard size	10

Government of Karnataka

Programme	Mechanical Engineering	**Semester**	III
Course Code	20ME34P	**Type of Course**	Programme Core
Course Name	**Fluid Power Engineering**	**Contact Hours**	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P :: 3:1:4	**Credits**	6
CIE Marks	60	**SEE Marks**	40

DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

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)
			3 hours/week	1 hour/week	4 hours/week (2 hours/batch twice in a week)
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**

- ***PO= Program Outcome as listed and defined in year 1 curriculum**
- **Course Co-Ordinator must prepare PO – CO mapping with strength (Low/Medium/High) before course planning**

Table 1: Suggestive Activities for Tutorials: (The List is only shared as an Example and not inclusive of all possible activities of the course. Student and Faculty are encouraged to choose activities that are relevant to the topic and on the availability of such resources at their institution)

Sl.No.	Suggestive Activities for Tutorials
01	Document and present the application of Pascal's Principle in Real Life by selecting Hydraulic Jack/Hydraulic Brakes/ Hydraulic Lift https://www.studiousguy.com
02	Present a report on possible failures in Submersible Pumps and trouble shoot the same.
03	Discuss and present the application of Pneumatics in farming using case study: Farming in California- The issues and Positivity's
04	Build and Present an Electro-Pneumatic Brake system used in Trains. Also, document Brake Cylinder Pressure effect.
05	Prepare a line Diagram of the pipe line of your Residence or College
06	Prepare a water distribution line diagram from Water reservoir to college
07	Prepare a line diagram for rain water harvesting of your Residence or College
08	Study and prepare a report on water distribution in Dip Irrigation System.

4. CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill test reduced to 20
5	CIE-5 Skill Test-Practice	12	180	100	
6	CIE-6 Portfolio continuous evaluation of Tutorial sessions through Rubrics	1-13		10	10
				Total CIE Marks	60
	Semester End Examination (Practice)		180	100	40
				Total Marks	**100**

5. Format for CIE written Test

Course Name	Manufacturing Processes	Test	I/II/III	Sem	III/IV
Course Code	20ME33P	Duration	80 Min	Marks	30

Note: Answer any one full question from each section. Each full question carries 10 marks.

Section	Assessment Questions	Cognitive Levels	Course Outcome	Marks
I	1			
	2			
II	3			
	4			
III	5			
	6			

Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.

5. (a)For CIE Skill Test -4 Duration :240 Min

SL. No.		CO	Particulars/Dimension	Marks
1		01	One Experimental Question on case related to Application of Bernoulli's theorem (Venturimeter/Orifice/Pitot tube) (Group of 5 Students) • Writing observations and Tabular column -- 10 Marks • Writing Equations required With all notations –- 15 Marks	45

			• Conduction of Experiment --- 10 Marks • Calculation and Result --- 10 Marks	
2		01	One Experimental Question on Channels/ Pipes (Group of 5 Students) • Writing observations and Tabular column -- 10 Marks • Writing Equations required With all notations –- 15 Marks • Conduction of Experiment --- 10 Marks • Calculation and Result --- 10 Marks	45
3		01	Portfolio evaluation based on the average of all Practice Sessions (1-6 Weeks)	10
	Total Marks			**100**

5. (b) For CIE Skill Test -5 **Duration: 240 Min**

SL. No.	**CO**	**Particulars/Dimension**	**Marks**
1	03,04	Two Skill based Question to Design a Pneumatic Circuit for the given case (Individual Experiment) = 45 Marks each • Writing Circuit Diagram with all components-25 marks • Building Circuit on the Kit -10marks • Showing the Result/output - 10 Marks	90
2	03,04	Portfolio evaluation based on the average of all Practice Sessions (7-12 Weeks)	10
Total Marks			**100**

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
					Average Marks= (8+6+2+2)/4=4.5		**5**

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. 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

8. 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

9. SEE Scheme of Evaluation **Duration :180 Min**

SL. No.	CO	Particulars/Dimension	Marks
1	01	One Experimental Question on case related to Application of Bernoulli's theorem (Venturimeter/Orifice/Pitot tube) (Group of 5 Students) • Writing observations and Tabular column -- 10 Marks • Writing Equations required With all notations –-15 Marks • Conduction of Experiment --- 10 Marks • Calculation and Result --- 1 5 Marks **OR** One Experimental Question on Channels/Pipes (Group of 5 Students) • Writing observations and Tabular column -- 10 Marks • Writing Equations required With all notations –-1 5 Marks • Conduction of Experiment --- 10 Marks • Calculation and Result --- 1 5 Marks	50
2	03,04	One Skill based Question to Design a Pneumatic Circuit for the given case (Individual Experiment)	30

		• Writing Circuit Diagram with all components-20 marks • Building Circuit on the Kit and Result -10 marks	
3	CO1,CO2,CO3,CO4	Viva voce	20
	Total Marks		**100**

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

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

ಮೂರನೇ ಸೆಮಿಸ್ಟರ್

ಕನ್ನಡ ಬಲ್ಲ ಡಿಪ್ಲೋಮಾ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ನಿಗದಿಪಡಿಸಿದ ಪಠ್ಯಕ್ರಮ

(ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ, ಸಂಸ್ಕೃತಿ ಮತ್ತು ಪರಂಪರೆ ಕುರಿತು)

Course Code	20KA31T	Semester : III	Course Group - AU
Course Title	**ಸಾಹಿತ್ಯ ಸಿಂಚನ – 2**	Category : Audit	Lecture Course
No. of Credits	2	Type of Course	CIE Marks : 50
Total Contact Hours	02 Hrs Per Week 26 Hrs Per Semester	Prerequisites Teaching Scheme (L:T:P)= 2:0:0	SEE Marks : Nil

ಸಾಹಿತ್ಯ ಸಿಂಚನ – 2 ಪಠ್ಯಕ್ರಮ - 20KA31T

26 ಗಂಟೆಗಳು

ಪಠ್ಯಕ್ರಮದ ಪರಿವಿಡಿ	**ಬೋಧನಾ ಅವಧಿ**
1. ಹೊಸಗನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆಯ ಪ್ರಭಾವಗಳು ಮತ್ತು ಪ್ರೇರಣೆಗಳು	**01 ಗಂಟೆ**
2. ಹೊಸಗನ್ನಡ ಕಾವ್ಯದ ಪ್ರಕಾರಗಳು -	**02 ಗಂಟೆ**
• ನವೋದಯ ಸಾಹಿತ್ಯ - ಲಕ್ಷಣಗಳು ಮತ್ತು ಪ್ರೇರಣೆ, ಪ್ರಮುಖ ಕವಿಗಳು ಮತ್ತು ಸಾಹಿತ್ಯದ ಕೊಡುಗೆಗಳು. • ನವ್ಯ ಸಾಹಿತ್ಯ - ಲಕ್ಷಣಗಳು ಮತ್ತು ಪ್ರೇರಣೆ, ಪ್ರಮುಖ ಕವಿಗಳು ಮತ್ತು ಸಾಹಿತ್ಯದ ಕೊಡುಗೆಗಳು. • ಬಂಡಾಯ ಮತ್ತು ಪ್ರಗತಿಪರ ಸಾಹಿತ್ಯ - ಲಕ್ಷಣಗಳು ಮತ್ತು ಪ್ರೇರಣೆ, ಪ್ರಮುಖ ಕವಿಗಳು ಮತ್ತು ಸಾಹಿತ್ಯದ ಕೊಡುಗೆಗಳು. • ದಲಿತ ಸಾಹಿತ್ಯ, ಮಹಿಳಾ ಸಾಹಿತ್ಯ, ವಿಜ್ಞಾನ ಸಾಹಿತ್ಯ ಮತ್ತು ಇತ್ತೀಚಿನ ಪ್ರಚಲಿತ ಕನ್ನಡ ಸಾಹಿತ್ಯ - ಲಕ್ಷಣಗಳು ಮತ್ತು ಪ್ರೇರಣೆ, ಪ್ರಮುಖ ಕವಿಗಳು ಮತ್ತು ಸಾಹಿತ್ಯದ ಕೊಡುಗೆಗಳು.	**03 ಗಂಟೆ** **03 ಗಂಟೆ** **03 ಗಂಟೆ** **03 ಗಂಟೆ**
3. ವೈಚಾರಿಕತೆ ಕುರಿತಾದ ಲೇಖನ - **ಜಿ ಎಸ್. ಶಿವರುದ್ರಪ್ಪ**	**01 ಗಂಟೆ**
4. ಕಥೆ - **ನೇಮಿಚಂದ್ರ**	**01 ಗಂಟೆ**
5. ಪ್ರವಾಸ ಕಥನ - **ಹಿ.ಚಿ.ಬೋರಲಿಂಗಯ್ಯ**ರವರ (ಕುಪ್ಪಳ್ಳಿ ಡೈರಿ ಪುಸ್ತಕದಿಂದ)	**01 ಗಂಟೆ**
6. ಪರಿಸರ, ವಿಜ್ಞಾನ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ ಕುರಿತಾದ ಲೇಖನಗಳು	**01 ಗಂಟೆ**
7. ಪ್ರಬಂಧ - **ಗೊರೂರು ರಾಮಸ್ವಾಮಿ ಅಯ್ಯಂಗಾರ**	**01 ಗಂಟೆ**
8. ಪ್ರಚಲಿತ ವಿದ್ಯಮಾನಕ್ಕೆ ಸಂಬಂಧಿಸಿದ ಲೇಖನ - "ಪೇರು ಮಾರುಕಟ್ಟೆ ಮತ್ತು ಹಣಕಾಸು ನಿರ್ವಹಣೆ" ಕುರಿತಂತೆ	**01 ಗಂಟೆ**
9. ಕರ್ನಾಟಕ ಏಕೀಕರಣ ಚಳುವಳಿ - **ಪ್ರೊ. ಜಿ. ವೆಂಕಟಸುಬ್ಬಯ್ಯ**	**01 ಗಂಟೆ**
10. ಕನ್ನಡ ಸಿನಿಮಾರಂಗ ಬೆಳೆದು ಬಂದ ದಾರಿ ಮತ್ತು ನಾಡು-ನುಡಿ ಹಾಗೂ ನಾಡಿನ ಸಂಸ್ಕೃತಿಯ ಮೇಲೆ ಬೀರಿದ ಪ್ರಭಾವಗಳು	**01 ಗಂಟೆ**
11. ಕನ್ನಡದ ಸಾಮಾಜಿಕ ಉಪಭಾಷೆಗಳು (ಭಾಷಾ ಪ್ರಭೇದಗಳು)	**01 ಗಂಟೆ**
12. ಆಧುನಿಕ ಕನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆಯ ಒಂದು ಅವಲೋಕನ	**02 ಗಂಟೆ**
ಒಟ್ಟು ಬೋಧನಾ ಅವಧಿ 26 ಗಂಟೆಗಳು	**26 ಗಂಟೆ**

ಕನ್ನಡ ಬಾರದ / ಕನ್ನಡೇತರ ಡಿಪ್ಲೋಮಾ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಕನ್ನಡ ಕಲಿಸಲು ನಿಗದಿಪಡಿಸಿದ ಪಠ್ಯಕ್ರಮ

Course Code	20KA31T	Semester : III	Course Group - AU
Course Title	**ಬಳಕೆ ಕನ್ನಡ – 2**	Category : Audit	Lecture Course
No. of Credits	2	Type of Course	CIE Marks : 50
Total Contact Hours	2 Hrs Per Week 26Hrs Per Semester	Prerequisites Teaching Scheme (L:T:P)= 2:0:0	SEE Marks : Nil

ಬಳಕೆ ಕನ್ನಡ – 2 ಪಠ್ಯಕ್ರಮ - 20KA31T

Table of Contents (ಪರಿವಿಡಿ) **26 ಗಂಟೆಗಳು**

Part – 1	**Teaching Hour**
Necessity of learning a local language (Continuation). Tips to learn the language with easy methods (Continuation). Easy learning of a Kannada Language: A few tips (Continuation). Hints for correct and polite conversation (Continuation). Instructions to Teachers for Listening and Speaking Activities (Continuation). Instructions to Teachers for Reading and Writing Activities (Continuation).	**01 Hour**
Part – II	
Key to Transcription for Correct Pronunciation of Kannada Language (Continuation). Instructions to Teachers to teach Kannada Language (Continuation).	**02 Hour**
Part – III Lessons to teach Kannada Language **(Speaking, Listening, Reading and Writing Activities with Explanation)**	
Lesson – 1 Personal Pronouns, Possessive Forms, Interrogative words – Part II	**02 Hour**
Lesson – 2 Permission, Commands, encouraging and Urging words (Imperative words and sentences) – Part II	**02 Hour**
Lesson – 3 Comparative, Relationship, Identification and Negation Words – Part II	**02 Hour**
Lesson – 4 Different types of forms of Tense (Use and Usage of Tense in Kannada) – Part II	**02 Hour**
Lesson – 5 Kannada Helping Verbs in Conversation (Use and Usage of Verbs) – Part II	**02 Hour**
Lesson – 6 Formation of Past, Future and Present Tense Sentences with Changing Verb Forms	**02 Hour**
Lesson – 7 Karnataka State and General Information about the State	**02 Hour**
Lesson – 8 Kannada Language and Literature	**02 Hour**
Lesson – 9 Do's and Don'ts in Learning a Language	**02 Hour**
PART - IV Reading and writing Practice of Kannada Language	
Lesson – 10 Kannada Language Script Part – 1	**02 Hour**
Lesson – 11 Kannada Language Script Part – II (Continuation)	**02 Hour**
Lesson – 12 Kannada Vocabulary List : **ಸಂಭಾಷಣೆಯಲ್ಲಿ ದಿನೋಪಯೋಗಿ ಕನ್ನಡ ಪದಗಳು** - Kannada Words in Conversation (Continuation).	**01 Hour**
Total Teaching Hours	**26 Hour**

ಸಾಹಿತ್ಯ ಸಿಂಚನ ಭಾಗ - II ಮತ್ತು **ಬಳಕೆ ಕನ್ನಡ ಭಾಗ - II** ಈ ಎರಡು ಪಠ್ಯಕ್ರಮಗಳಿಗೆ
CIE - ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನದ ಮಾರ್ಗಸೂಚಿಗಳು :

(Course Assessment and Evaluation Chart - CIE only)

Sl. No	Assessment	Type	Time frame in semester	Duration In minutes	Max marks	Conversion
1.	**CIE- Assessment - 1**	Written Test - 1	At the end of 3rd week	80	30	**Average of three written tests : 1, 2 & 3 for 30 Marks**
2.	**CIE- Assessment - 2**	Written Test - 2	At the end of 7th week	80	30	
3	**CIE- Assessment - 3**	Written Test - 3	At the end of 13th week	80	30	
4.	**CIE- Assessment - 4**	MCQ/Quiz	At the end of 5th week	60	20	**Average of three Assessment tests : 4, 5 & 6 for 20 Marks**
5	**CIE- Assessment - 5**	Open Book Test	At the end of 9th week	60	20	
6	**CIE- Assessment - 6**	Work book Consolidation & Activities	At the end of 11th week	60 (Work book Submission)	20	
Total CIE – Continuous Internal Evaluation Assessment Marks						50
Total Marks						50

ಸೂಚನೆ : 1.CIE - ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನದ 1, 2 ಮತ್ತು 3 ರ ಕಿರು ಪರೀಕ್ಷೆಗಳನ್ನು ಮತ್ತು ಮೌಲ್ಯಮಾಪನದ 4, 5 ಮತ್ತು 6 ರ ಪರೀಕ್ಷೆಗಳನ್ನು ಪ್ರತ್ಯೇಕ ಬ್ಲೂಬುಕ್ ಪುಸ್ತಕದಲ್ಲಿ ವಿದ್ಯಾರ್ಥಿಗಳು ಬರೆಯಬೇಕು.

2.ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದಲ್ಲಿ ವಿದ್ಯಾರ್ಥಿಗಳು, ತರಗತಿ ಕನ್ನಡ ಭಾಷಾ ಶಿಕ್ಷಕರಿಂದ ಮತ್ತು ವಿಭಾಗಾಧಿಕಾರಿ ಗಳಿಂದ ದೃಢೀಕರಣಗೊಂಡ ಕಾರ್ಯಪಠ್ಯಪುಸ್ತಕವನ್ನು (Work Book) ಮೌಲ್ಯಮಾಪನ ಭಾಗ-**CIE- Assessment – 6** ರ ಪರೀಕ್ಷೆಯ ನಂತರ ಆಯಾ ವಿಭಾಗಕ್ಕೆ ಸಲ್ಲಿಸಬೇಕು.

4TH SEMESTER

Government of Karnataka
DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Programme	Mechanical Engineering	**Semester**	IV
Course Code	20ME41P	**Type of Course**	Programme Core
Course Name	**Operations Management**	**Contact Hours**	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P :: 3:1:4	**Credits**	6
CIE Marks	60	**SEE Marks**	40

1. Rationale: The success of any organisation not only depends on quality of its products and services but also depends on the people within it. Thus, an operational manager has to play a prominent role in an organisation with human capital and machines. Therefore, managerial skills are essential for enhancing their employability and carrier growth. This course is therefore designed to provide basic concepts in operations management, forecasting techniques, capacity planning, aggregate planning, master production schedule, quality, and inventory and supply chain management for effective utilisation of resources and competitive advantage through operational excellence

2. Course Outcomes: On Completion of course, the student will be able to:

CO-01	Prepare a production capacity utilization plan based on demand forecast and available production capacity for a given product.
CO-02	Prepare a master production plan based on a production capacity utilization plan and a material management plan for a given product.
CO-03	Prepare a process plan using time study, motion study and other appropriate methods to ensure process efficiency.
CO-04	Prepare a quality assurance plan based on a given quality model which is suitable for either a product or a service organisation.

3. Course Content

Week	CO	PO*	Lecture (Knowledge)	Tutorial (Activity)	Practice (Skill)
			3 hours/week	1 hour/week	4 hours/week (2 hours/batch twice in a week)
1	01	01	**Introduction to Operation Management** 1. Introduction to Operation Management - Operation Functions 2. Evolutions and Historical Events in Operational Management 3. Productivity and Competitiveness, Strategy and operation	Ref Table 1	•Virtual Tour Organization (You tube) •Problems on Productivity
2	01	01	**DEMAND FORECASTING** 1.Demand Forecasting- Demand Behavior-Trend Cycle - Seasonal Background - Steps in Forecasting Process 2. Short range and Long Range Forecast 3. Qualitative Forecast methods	Ref Table 1	Problems on •Qualitative Forecast - Delphi method, Market Research method •Quantitative Forecast - Time series Method a) Moving average (Naive forecast , Simple moving

					Average, Weighted moving Average)
3	01	01	1. Quantitative Forecast methods 2. Seasonal Adjustments 3. Forecast Accuracy	Ref Table 1	Problems on b) Exponential smoothing
4	01	01	**CAPACITY AND AGGREGATE PLANNING** 1. Need for Capacity Planning – Capacity expansion Strategies – Capacity planning Models. 2. Aggregate planning- Methods 3. Master production Schedule	Ref Table 1	Problems on •Capacity Planning, •Aggregate planning •Master production Schedule
5	01	01	**PROCESS PLANNING** 1. Make or Buy Decision Outsourcing- Factors for Outsourcing decision- Process Selection – Batch , Mass ,Continuous Components of e-manufacturing	Ref Table 1	•Virtual Tour on Batch, Mass and continuous Process •Develop an Operation Sheet indicating Process Plan and Process flow chart for a given component.
6	03	01	1.Motion Study 2. Man- Machine chart 3. Concepts on Time Study	Ref Table 1	•Develop Job Process chart with Process Symbols for a given Process. •Develop Man- Machine chart for a given Process. •Case study on Time Study Principles for a given process.
7	02	01	**INVENTORY MANAGEMENT** 1. Elements of Inventory Management- Inventory Costs- Carrying, Ordering and Shortage Costs 2.Inventory Control Systems- Continuous Inventory System (Fixed-Order-Quantity System) Periodic Inventory System (Fixed-Time-Period System) 3. Concept on ABC Classification, Economic Order Quantity Models, Production Quantity Model	Ref Table 1	Problems on •ABC Classification System •Economic Order Quantity Models •The Production Quantity Model
8	02	01,02	1. Order Quantity for A Periodic Inventory System Order Quantity with Variable Demand 2. JIT -Pull System 3 Kanban's System	Ref Table 1	Case study on JIT (Eg:Toyoto Production System)
9	02	01	**Supply Chain Management** 1.Supply Chains Supply Chains for Service Providers 2.Value Chains The Management of Supply Chains 3.Vendor Selection- Vendor	Ref Table 1	Study on •The Bullwhip Effect •Risk Pooling •Green Supply Chains

			evaluation and Vendor Development, Negotiations		
10	02	01	1.Supply Chain Uncertainty and Inventory 2.E-Business, Electronic Data Interchange 3.Supply Chain Integration-Collaborative Planning, Forecasting, And Replenishment	Ref Table 1	Study on •Information Technology: Supply Chain Enabler •Bar Codes •Radio Frequency Identification •Build-To-Order (BTO)
11	02	01,07	1.Material Requirements Planning (MRP) Enterprise Resource Planning (ERP), 2. Warehouse Management Systems Collaborative Logistics, Distribution Outsourcing 3.Finance/Accounting-Sales/Marketing-Production/Materials Management-Human Resources	Study the latest technological changes in this course and present the impact of these changes on industry	Case study on Procurement-Outsourcing. •E-Procurement •E-Market places •ERP MODULES
12	04	01,04,07	QUALITY MANAGEMENT 1. Quality from The Customer's Perspective Dimensions of Quality for Manufactured Products Dimensions of Quality for Services 2. Quality from The Producer's Perspective A Final Perspective On Quality The Cost of Quality The Cost of Achieving Good Quality 3. The Cost of Poor Quality The Quality–Productivity Ratio Quality Management System		Practice on Quality Tools •Process Flowcharts •5 Whys, Cause-And-Effect Diagrams •Check sheets And Histograms •Pareto Analysis •Scatter Diagrams
13	04	04,05,07	1. TQM and QMS The Focus of Quality Management—Customers 2. Quality Management in The Supply Chain The Role of Employees in Quality Improvement Kaizen and Continuous Improvement Quality Circles 3. Process Improvement Teams Six Sigma The Breakthrough Strategy: DMAIC		Practice on The Deming Wheel (PDCA Cycle) •Process Control Charts •Statistical Quality Control •ISO 9000 •ISO14000
Total in hours			**39**	**13**	**52**

- ***PO= Program Outcome as listed and defined in year 1 curriculum**
- **Course Co-Ordinator must prepare PO – CO mapping with strength (Low/Medium/High) before course planning**

Table 1: Suggestive Activities for Tutorials: (The List is only shared as an Example and not inclusive of all possible activities of the course. Student and Faculty are encouraged to choose activities that are relevant to the topic and on the availability of such resources at their institution)

<table>
<tr><th>Sl.No.</th><th>Suggestive Activities for Tutorials</th></tr>
<tr><td>01</td><td>Below are monthly sales of light bulbs from the lighting store.
<table>
<tr><td>MONTH</td><td>Jan</td><td>Feb</td><td>March</td><td>April</td><td>May</td><td>June</td></tr>
<tr><td>SALES</td><td>50</td><td>200</td><td>80</td><td>40</td><td>360</td><td></td></tr>
</table>
Forecast sales for June using the following

Naive method
Three- month simple moving average
Three-month weighted moving average using weights of 0 .5, 0.3 and 0.2
Exponential smoothing using an alpha of 0.2 and a May forecast of 350.
</td></tr>
<tr><td>02</td><td>Delph Manufacturing Company is going to purchase an auto parts component from one of two competing suppliers. Delph is going to base its decision, in part, on the supply chain performance of the two suppliers. The company has obtained the following data for average raw materials, work-in-process, and finished goods inventory value, as well as cost of goods sold for the suppliers
<table>
<tr><td>Items</td><td>Supplier 1</td><td>Supplier 2</td></tr>
<tr><td>Cost of goods sold</td><td>Rs 8,360,000</td><td>14,800,000</td></tr>
<tr><td>Raw materials</td><td>270,000</td><td>870,000</td></tr>
<tr><td>Work-In-Progress</td><td>62,000</td><td>550,000</td></tr>
<tr><td>Finished goods</td><td>33,000</td><td>150,000</td></tr>
</table>
Each company operates 52 weeks per year. Determine which supplier has the best supply chain performance according to inventory turns and weeks of supply. What other factors would the company likely take into account in selecting a supplier?</td></tr>
<tr><td>03</td><td>The maintenance department for a small manufacturing firm has responsibility for maintaining an inventory of spare parts for the machinery it services. The parts inventory, unit cost, and annual usage are as follows
<table>
<tr><td>Part</td><td>Unit Cost(Rs)</td><td>Annual Usage</td></tr>
<tr><td>1</td><td>100</td><td>90</td></tr>
<tr><td>2</td><td>350</td><td>40</td></tr>
<tr><td>3</td><td>30</td><td>130</td></tr>
<tr><td>4</td><td>20</td><td>180</td></tr>
<tr><td>5</td><td>320</td><td>50</td></tr>
</table>
The department manager wants to classify the inventory parts according to the ABC system to determine which stocks of parts should most closely be monitored</td></tr>
<tr><td>04</td><td>The design capacity for engine repair in our company is 80 trucks/day. The effective capacity is 40 engines/day and the actual output is 36 engines/day. Calculate the utilization and efficiency of the operation. If the efficiency for next month is expected to be 82%, what is the expected output?</td></tr>
<tr><td>05</td><td>County school buses are inspected every month for “defects.” In a recent monthly inspection, 27 worn or torn seats were found, 22 buses had dirty floors, there were 14 cases of exterior scratches and chipped paint, there were 8 cracked or broken windows, the engines on 4 buses had trouble starting or were not running smoothly, and 2 buses had faulty brakes. Develop a Pareto chart for the bus inspections and indicate the most significant quality-problem categories. What does this tell you about the limitations of applying Pareto chart analysis? How might these limitations be overcome in Pareto chart analysis</td></tr>
<tr><td>06</td><td>Study and prepare a report on Inventory management in A Super Bazaar</td></tr>
<tr><td>07</td><td>Case study on Supply chain Management in Amazon, Flikart etc</td></tr>
<tr><td>08</td><td>Case study on use of ERP in An Education Institution (From Admission to Award of Degree)</td></tr>
<tr><td>09</td><td>Case study on logistics management in Swiggy, Zomoto, Dunzo etc</td></tr>
</table>

4. CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill test reduced to 20
5	CIE-5 Skill Test-Practice	12	180	100	
6	CIE-6 Portfolio continuous evaluation of Tutorial sessions through Rubrics	1-13		10	10
				Total CIE Marks	60
Semester End Examination (Practice)			180	100	40
				Total Marks	**100**

5. Format for CIE written Test

Course Name	**Operation Management**	Test	I/II/III	Sem	IV
Course Code	**20ME41P**	Duration	80 Min	Marks	30

Note: Answer any one full question from each section. Each full question carries 10 marks.

Section	Assessment Questions	Cognitive Levels(R/U/A)	Course Outcome	Marks
I	1			
	2			
II	3			
	4			
III	5			
	6			

Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.

5 . (a) For CIE Skill Test -4 Duration: 240Min

SL. No.	CO	Particulars/Dimension	Marks
1	01	One Question- Problems/Case study on Demand forecasting/Master Scheduling/Capacity Planning	45
2	01,03	Based on the given Case Study, Prepare a Job Process chart with Process Symbols/Develop a Man- Machine chart	45
3	01,03	Portfolio evaluation based on the average of all Practice Sessions (1-6 Weeks)	10
Total Marks			**100**

5 . (b) For CIE Skill Test -5 Duration: 240 Min

SL. No.	CO	Particulars/Dimension	Marks
1	O2	One Question on Inventory Management and Supply Chain Management (JIT/ Kanban System /E- Business/)	45
2	O4	For the given case study , Prepare the Cost of achieving good Quality using any quality Tools	45
3	02,04	Portfolio evaluation based on the average of all Practice Sessions (7-12 weeks)	10
Total Marks			**100**

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
	Average Marks= (8+6+2+2)/4=4.5						**5**

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. Reference:

Sl. No.	Description
1	Production and Operations Management – Creating Value along the Supply Chain By Russel and Taylor , Wiley Publications , 7 Edition
2	Modern Production and Operation Management By Buffa and Sarin, Wiley Publications, 8 edition
3	Production and Operations Management By Chary, Tata Mc Graw Hill Publications
4	Production and Operations Management- Concepts, Models and Behaviour By Adam and Ebert, Prentice Hall Publications

8. LIST OF SOFTWARES/ LEARNING WEBSITES:

1. www.youtube.com/watch?v=SF53ZZsP4ik
2. www.youtube.com/watch?v=iPZlQ3Zx5zc

9. SEE Scheme of Evaluation Duration :180 Min

SL. No.	CO	Particulars/Dimension	Marks
1	O1,02,03	One Question- Problems/Case study on Demand forecasting/Master Scheduling/Capacity Planning **OR** Based on the given Case Study, Prepare a Job Process chart with Process Symbols/Develop a Man- Machine chart	**40**
2	O3,O4	One Theory Question on Inventory Management and Supply Chain Management (JIT/ Kanban System /E- Business/) **OR** For the given case study , Prepare the Cost of achieving good Quality using any quality Tools	**40**
3	01,0203,04	Viva voce	20
	Total Marks		**100**

10. Tools/ Equipment/ Software's Required

1.ERP Software