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ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. (Full Time) - END SEMESTER EXAMINATIONS, APRIL / MAY 2024

MECHANICAL ENGINEERING BRANCH
Semester - VI
ME5081 Process Planning and Cost Estimation
(Regulation 2019)

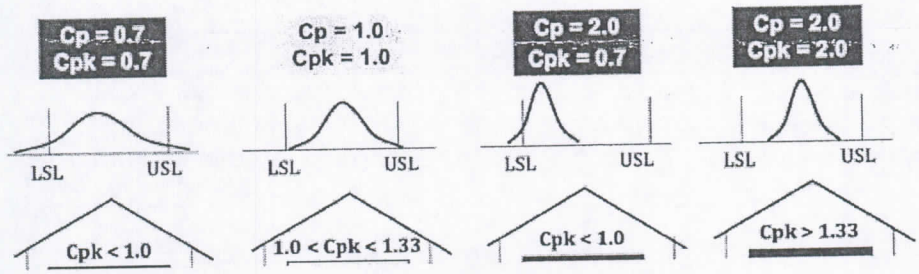
Time: 3 hrs

Max.Marks: 100

CO1	Create a process plan for a given product.
CO2	Prepare cost elements for a given product.
CO3	Allocate overhead to different departments.
CO4	Estimate the cost for casting, welding and forging.
CO5	Analyze the costs for machining a product.

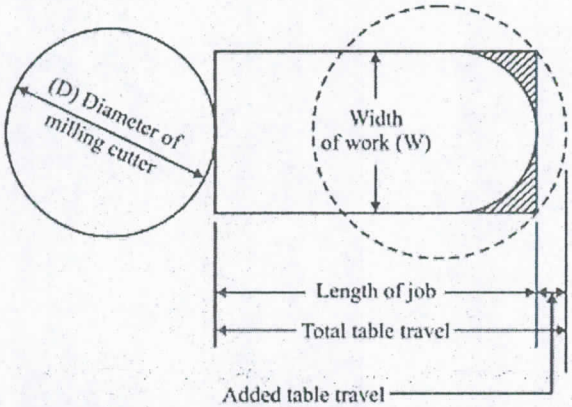
BL – Bloom's Taxonomy Levels
(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

PART- A(10x2=20Marks)
(Answer all Questions)

Q.No.	Questions	Marks	CO	BL
1.	Match the following: **Type of Layout** / **Features** / **Product** Process – Inflexible to significant changes in product design. – Car assembly Product – Distinct part families and expanded worker training. – Tools and Gauges Fixed Position – Large work-in-process and increased material handling. – Ball Bearings Cellular – Low set-up cost and high skill requirement. – Large Boilers	2	1	2
2.	 If you were a process planner, what would you infer about the capability of the manufacturing process from the given graph.	2	1	2
3.	If one wanted to double the volume of an investment casting turbine blade from 3 to 6 cubic centimeters, what would be the increase in cost? Apply the rule of six-tenths.	2	2	2
4.	If a part is made from steel which costs ₹75 per kg and weighs 2 kg, what is the estimated material cost, part cost and selling price? Use 1: 3: 9 rule, and 10% allowances for scrap.	2	2	2
5.	A customer order of 50 parts is to be processed through a plant. Raw materials and tooling are supplied by the customer. The total time for	2	3	2

	Direct labor cost is ₹150.00/hr. The factory overhead rate is 250% and the corporate overhead rate is 600%. What price should be quoted to the customer if the company uses a 10% markup?			
6.	In a manufacturing process, the observed time for 1 cycle of operation is 0.5 min. The rating factor is 125%. The following are the various allowances as % of normal time: Personal allowance = 3% Relaxation allowance = 10% Delay allowance = 2% Estimate the standard time	**2**	3	2
7.	Match any four terms in the following lists, which are related to arc and gas welding processes.	**2**	4	2

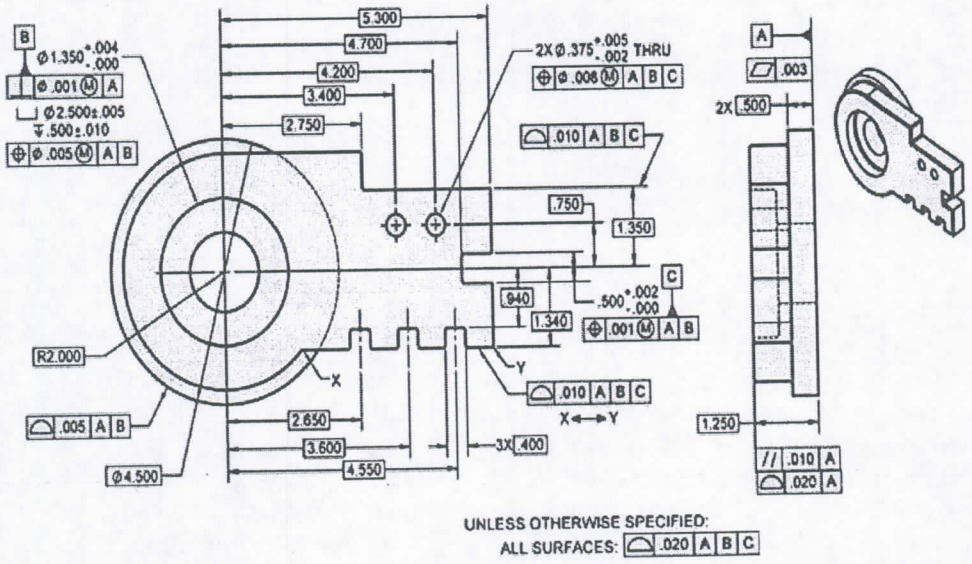
List-I	List-II	List-III
Neutral Flame	Acetylene feather	Thin plates welding (less than 5 mm)
Oxidizing Flame	Torch Angle 40° - 50°	Bronze and copper plates
Carburizing Flame	Torch Angle 60° - 70°	Thick plates welding
Rightward Welding	Pointed Inner cone	Low carbon and mild steel
Leftward Welding	Commonly used flame for gas welding	Aluminium alloys

8.	What do you understand by the term 'scale loss' in forging?	**2**	4	2
9.	Find the length of the added table travel for the face milling shown in the figure below.  	**2**	5	2
10.	Calculate the time required to tap a hole with 25 mm dia. Tap to a length of 30 mm having 3 threads per cm. The cutting speed is 10 m/min. For return stroke the speed is 2 times the cutting speed. The tapping is completed in 3 passes.	**2**	5	2

PART- B(5x 13=65Marks)

(Restrict to a maximum of 2 subdivisions)

Q.No.	Questions	Marks	CO	BL
11 (a)	Compare Generative and Retrieval CAPP based on i. Methodology ii. Suitability for the type of production	**13**	1	2
	OR			
11 (b)	i. Interpret the meaning of any three dimensional tolerance symbols and two feature control frames from the figure given below. All the mentioned dimensions are in mm.	**7**	1	2



	ii. Infer the materials and shapes that can be processed and produced by the following manufacturing processes. a) Investment casting b) Filament winding c) Vacuum bag d) Wire-cut EDM	6	1	2
12 (a)	From the following data for a sewing machine manufacturer, prepare a statement showing prime cost, factory cost, production cost, total cost and profit.	13	2	3

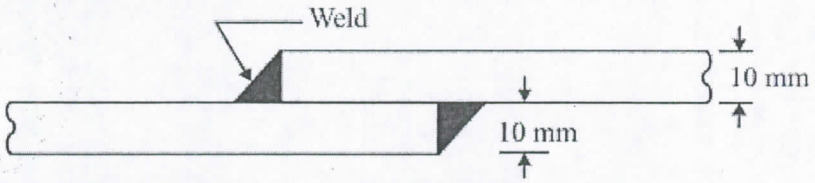
	₹
Value of stock of material as on 1-04-2023	26,000
Material purchased	2,74,000
Wages to labour	1,20,000
Depreciation of plant and machinery	8,000
Depreciation of office equipment	2,000
Rent, taxes and insurance of factory	16,000
General administrative expenses	3,400
Water, power and telephone bills of factory	9,600
Water, lighting and telephone bills of office	2,500
Material transportation in factory	2,000
Insurance and rent of office building	2,000
Direct expenses	5,000
Commission and pay of salesman	10,500
Repair and maintenance of plant	1,000
Works Manager salary	30,000
Salary of office staff	60,000
Value of stock of material as on 31-03-2024	36,000
Sale of products	6,36,000

OR

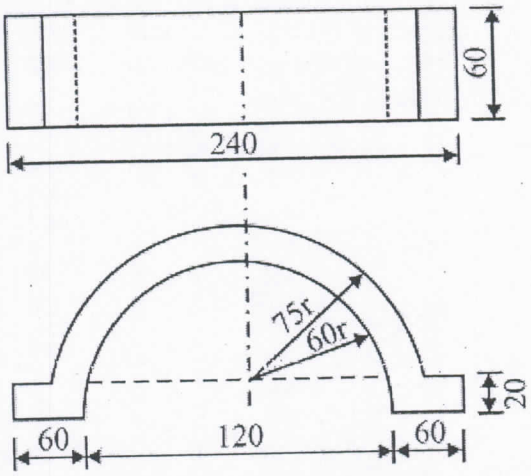
12 (b)	A component can be produced with facility using either a numerically controlled milling machine, or an operator controlled milling machine (conventional machine). For situation (a): Which process should be chosen for minimum costs if two components only are required? Determine the difference in manufacturing cost by arriving a mathematical equation. (Assume no special tooling for the conventional machine and hence no fixed costs, but it is a tool-room universal milling machine with high overheads.) For situation (b): Draw the break-even chart and determine which process should be chosen for minimum costs if a batch of 150 components is	13	2	3

	required. Calculate the difference in manufacturing cost from the graph. (Assume special tooling such as fixture and gauges are required for the conventional machine, which is a plain milling machine on a production line). The following cost information is known.			

	Situation (a)		Situation (b)	
	N/C Machine	Conventional machine	N/C Machine	Conventional machine
Fixed Cost	₹800	₹0	₹800	₹3,000
Labour/part	₹15.00	₹125.00	₹15.00	₹3.50
Material/part	₹10.00	₹10.00	₹10.00	₹10.00
Overheads/part	₹30.00	₹300.00	₹30.00	₹22.50

13 (a)	In the operation of a certain production machine, one worker is required at a direct labor rate = ₹10 per hour. Applicable labor factory overhead rate = 50%. Capital investment in the machine = ₹9,50,000, expected service life = 10 years, with salvage value of ₹80,000 at the end of the service period. Applicable machine factory overhead rate = 30%. The work cell will operate 2000 hours per year. Rate of return is 20%. Suppose that the machine's salvage value is ₹30,000. Determine the effect of decreased salvage value on the hourly rate. Apply the concepts of capital recovery factor and sinking fund.	**13**	3	3
	OR			
13 (b)	A CNC machine was purchased for ₹25,75,000 on 15th July 2006, the erection and installation cost was ₹50,000. The CNC machine is to be replaced by a new one on 14th July 2024. The scrap value is ₹1,50,000. Take rate of interest as 5%. Determine the sum of the depreciation amount after 5 years of installation by i. Straight line method ii. Diminishing balance method iii. Annuity method iv. Sinking fund method v. Sum of the years' digit method	**13**	3	3
14 (a)	A lap welded joint is to be made as shown in figure below.  Estimate the cost of weld from the following data: Total length of double fillet weld is 3 m. Thickness of plate = 10 mm Electrode diameter = 6 mm Minimum arc voltage = 30 V Current used = 250 A Welding speed = 10 meters/hour Electrode used per meter of weld = 0.350 kg Labour rate = ₹40 per hour Power rate = ₹3 per kWh Electrode rate = ₹8.00 per kg Efficiency of welding m/c = 50 per cent Connecting ratio = 0.4 Overhead charges = 80 per cent of direct charges Labour accomplishment factor = 60 per cent	**13**	4	3
	OR			
14 (b)	Calculate the total cost of CI (Cast Iron) cap shown in the figure below from the following data:	**13**	4	3

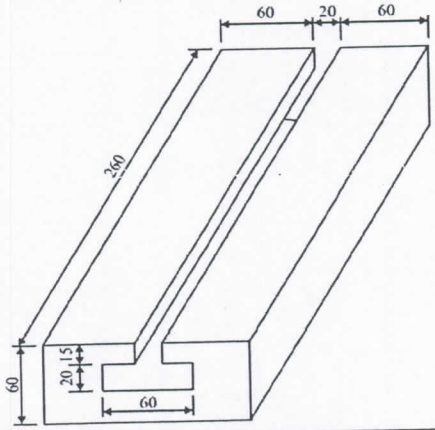
Process scrap = 17 per cent of net wt. of casting
Process scrap return value = ₹5 per kg
Administrative overhead charges = ₹2 per kg of metal poured.
Density of material used = 7.2 g/cc

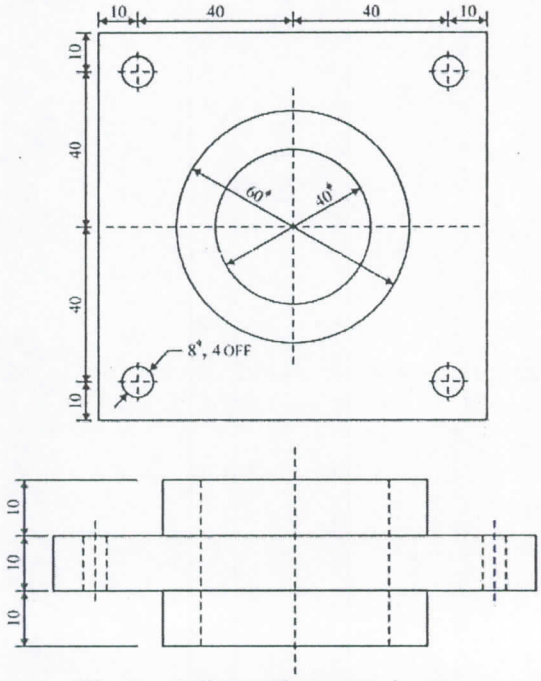


(Part dimensions are in mm)

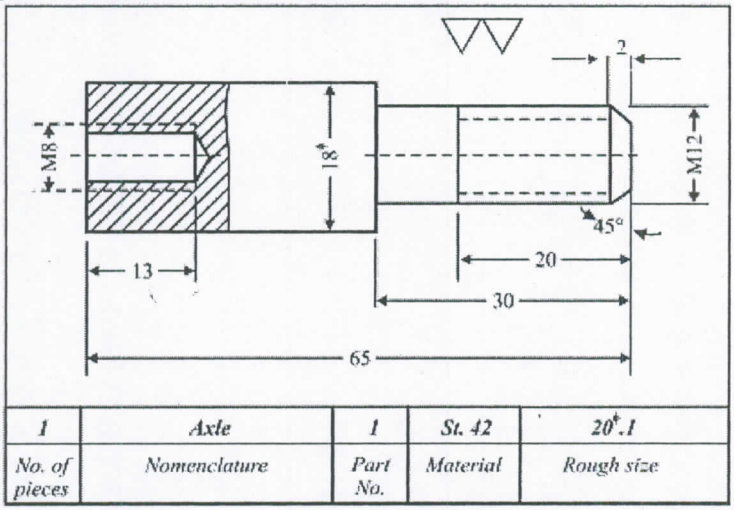
The other expenditure details are:

Process	Time per piece in min.	Labour charges per hour in ₹	Shop overheads per hour in ₹
Moulding and pouring	10	30	30
Casting removal, gate cutting etc.	4	10	30
Fettling and inspection	6	10	30

15 (a)	i. A T-slot is to be cut in a C.I. slab as shown in the figure below (Part dimensions are in mm). Estimate the machining time. Cutting speed is 25 m/min, feed is 0.25 mm/rev. Diameter of cutter for channel milling is 80 mm. 	7	5	3
	ii. Mild steel shaft 30 cm long is to be rough ground from 43.3 mm dia. to 43 mm dia. using a grinding wheel of 40 mm face width and fine ground from 40 mm to 39.9 mm dia. Calculate the time required to grind the job assuming work speed of 12 m/min and depth of cut 0.02 mm per pass.	6	5	3
	OR			
15 (b)	i. Derive the expression to calculate the total time (cutting time + quick return time) of a shaper machine, and also determine the time required on a shaper to machine a plate 600 mm × 1,200 mm, if the cutting speed is 15 meters/min. The ratio of return stroke time to cutting time is 2:3. The clearance at each end is 25 mm along the length and 15 mm on width. Two	7	5	3

	cuts are required, one roughing cut with cross feed of 2.5 mm per stroke and one finishing cut with feed of 1 mm per stroke.			
	ii. Determine the machining time to drill four 8 mm dia. holes and one 40 mm dia. Central hole in the flange shown in the following figure. 20 mm dia. hole is drilled first and then enlarged to 40 mm dia. hole. Cutting speed is 10 m/min, feed for 8 mm drill is 0.1 mm/rev, for 20 mm drill feed is 0.2 mm/rev. and for 40 mm dia. drill feed is 0.4 mm/rev.  The part dimensions are in mm.	**6**	5	3

PART- C(1x 15=15Marks)
(Q.No.16 is compulsory)

Q.No.	Questions	Marks	CO	BL
16.	Create a process plan and generate an operation sheet for the part drawing shown below. Part dimensions are in mm. 	**15**	1	6

1	*Axle*	*1*	*St. 42*	*20*.1*
No. of pieces	*Nomenclature*	*Part No.*	*Material*	*Rough size*