## ME9793 PROCESS PLANNING AND COST ESTIMATION

## UNIT-I

### Part-A (2 Marks)

1. Define Process planning.

2. What are the process planning activities?

3. What are the types of process planning?

4. Define Generative CAPP systems.

5. What are all the types of drawing?

6. What are the stages in Process selection?

7. Brief about scope of process planning.

8. What are the documents used in process planning?

9. Define the term "Route sheet"

10. Write any four cutting tool materials.

11. List the objectives of process planning.

12. What are the types of process chart?

13. What do you mean by standard time?

14. Where string diagram is used?

15. What are the methods used for selection of machinery?

16. Define product design.

17. What designing includes in product design?

18. What are factors influencing the Operational Aspects in product analysis?

19. What is bilateral tolerance?

20. What is the use of collective assembly drawings?

### Part-B (16 Marks)

1. What are the factors that influence process planning? Discuss.

2. Explain tool selection method.

3. Explain the various approaches to process planning.

4. List and explain the various factors considered for tooling selection.

5. Explain the various factors considered in product selection.

6. Explain the various types of drawing in details.

7. What are the procedures to be followed for the machine selection? Explain.

8. In the design of a jet engine part, the designer has a choice of specifying either an aluminium alloy casting or a steel casting. Either material will provide equal service, but the aluminium casting will weigh 1.2 kg as compared with 1.35 kg for the steel casting. The aluminium can be cast for        Rs. 80.00 per kg. and the steel one for Rs. 35.00 per kg. The cost of machining per unit is Rs. 150.00 for aluminium and Rs. 170.00 for steel. Every kilogram of excess weight is associated with a penalty of Rs. 1,300 due to increased fuel consumption. Which material should be specified and what is the economic advantage of the selection per unit?

9. Discuss the production equipment and tool selection for the component show in fig. Under cut diameter is 12 mm
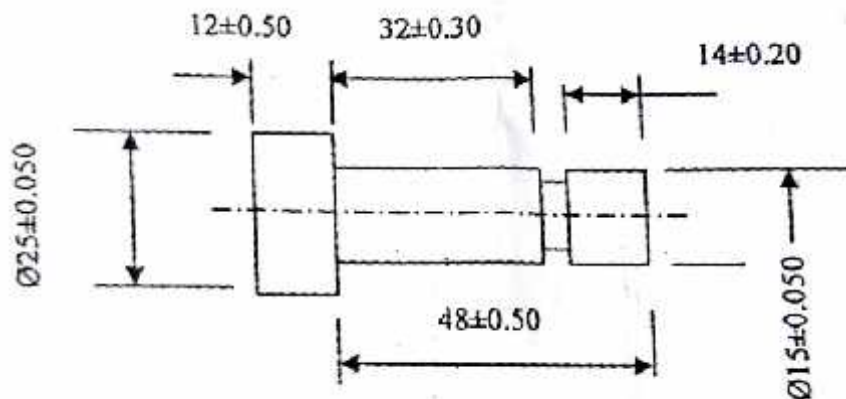


10. What are the factors that influence tool selection? Discuss.

11. What are the factors that affecting in equipment selection.

12. Explain the various methods of process planning.

13. Discuss in steps in tooling selection method.

14. Describe the set of documents required in process planning.

15. Explain the steps in process selection with suitable examples

16. Explain the factors considered in product selection

17. Two alternatives are under consideration for a tapered fastening pin. Either design will serve the purpose and will involve the same material and manufacturing cost except for the lathe and grinder operations. Design A will require 16 hours of lathe time and 4.5 hours of grinder time per 1,000 units.

Design B will require 7 hours of lathe time and 12 hours of grinder time per 1,000 units. The operating cost of the lathe including labour is Rs. 200 per hour. The operating cost of the grinder including labour is Rs. 150 per hour. Which design should be adopted if 1,00,000 units are required per year and what is the economic advantage of the best alternative?

18. In the design of buildings to be constructed in Alpha State, the designer is considering the type of window frame to specify. Either steel or aluminium window frames will satisfy the design criteria. Because of the remote location of the building site and lack of building materials in Alpha State, the window frames will be purchased in Beta State and transported for a distance of 2,500 km to the site. The price of window frames of the type required is Rs. 1,000 each for steel frames and Rs. 1,500 each for aluminium frames. The weight of steel window frames is 75 kg each and that of aluminium window frame is 28 kg each. The shipping rate is Re 1 per kg per 100 km. Which design should be specified and what is the economic advantage of the selection?

## UNIT-II
### Part-A (2 Marks)

**1.** What is the objective of process planning?

2. What are the functions of process planning?

3. What are factors consider for Economic analysis?

4. What are the aims of break-even analysis?

5. What are the assumptions in break-even analysis?

6. What you mean by break-even point?

7. What are the methods of determination of break-even point?

8. Define Cutting speed.

9. What do you mean by Break-even point in terms of Sales Value?

10. Define contribution

11. What do you mean by margin of safety?

12. What are the limitations of break-even analysis?

13. Write the concept of process planning?

14. What are the information required to preparing operation planning sheet?

15. Write the procedure of process planning.

16. Define work holding device.

17. What is mean by Jigs?

18. What are the elements of jigs and fixtures?

19. What are the factors affecting feed rate?

20. Define depth of cut.

## PART B

1. What are the main process parameters than can influence the success of the machining?

2. What is the purpose of a work holding device? List the types of work holding devices.

3. List out the set of documents that are required for process planning.

4. What do you understand by break even analysis? List the objectives.

5. List the various factors that influence the design or selection of a work holder.

6. What is meant by cutting speed? Also list the major factors that are to be considered during selection of cutting speed.

7. What is meant by feed rate? List the major factors that are to be considered during the selection of feed rate.

8. Discuss about the factors to be considered in the selection of jigs and fixtures for cost reduction.

9. Explain on economics of process planning.

10. From the following data, calculate break-even point expressed in terms of units and also the new break-even point, if selling price is reduced by 10%. Fixed expenses; Depreciation = Rs.1,25,000; Salaries = Rs. 1,00,000 ; Variable expenses; Materials = Rs. 4 per unit; Labour=Rs. 2 per unit; Selling price Rs.15 per unit

11. Discuss about the factors to be considered for selection of depth of cut.

12.Alpha Associates has the following details; Fixed cost = Rs. 20, 00,000; Variable cost per unit = Rs. 100; Selling price per unit = Rs. 200; Find  (a) The break-even sales quantity (b) The break-even sales (c) If the actual production quantity is 60,000 Find (i) Contribution (ii) Margin of safety by all methods.

13. Prepare the operation planning sheet for the given component.
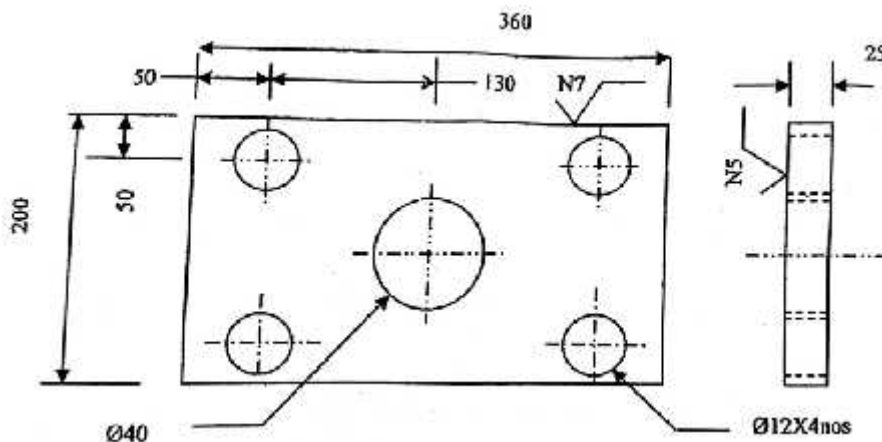
14. Consider the following data of a company for the year 2016 ; Sales = Rs. 1, 20,000 Fixed cost = Rs. 25,000; Variable cost = Rs. 45,000; Find the following: (a) Contribution (b) Profit (c) BEP (d) M.S.

## UNIT-III
### Part-A (2 Marks)

1. What is meant by Cost estimation?
2. Define costing.
3. Define cost accounting.
4. What do you meant by catalogue price?
5. What are the objectives of costing?
6. State the functional estimating.
7. What is direct material cost?
8. What is indirect material cost?
9. What is direct labour cost?
10. What is setup time?
11. What do you understand by estimating?
12. What are the types of estimator?
13. What is prime cost?
14. Name a few methods of cost estimates.
15. What do you by multiple cost method?
16. State some functions of estimating.
17. Give the methods of costing.
18. What is make or buy decision?
19. What is the difference between cost estimating and cost accounting?
20. What are the constituents of a job estimate?
21. What do you meant by a realistic estimate?
22. What are allowances in estimation?

### Part-B (16 Marks)

1. State and explain the objectives of cost estimation.
2. Discuss in details about the types and methods of estimating.

3. What are all the three methods used in conceptual cost estimation.

4. Explain the procedure involved in cost estimation.

5. Define cost accounting. Describe cost accounting with examples.

6. Write down the step by step procedure for estimating the direct material cost.

7. Explain the estimation of material cost with examples.

8. List down the various items that constitute the overheard expenses.

9. Elaborate the various elements of the cost with suitable examples.

10. What are the various time allowances which should be considered for calculation labour cost.

11. What do you understand by depreciation of a machine? Discuss the various causes of depreciation.

12. Calculate the selling price per unit from the following data : Direct material cost = Rs. 8,000 Direct labour cost = 60 percent of direct material cost Direct expenses = 5 percent of direct labour cost Factory expenses = 120 percent of direct labour cost Administrative expenses = 80 percent direct labour cost Sales and distribution expenses = 10 percent of direct labour cost Profit = 8 percent of total cost No. of pieces produced = 200.

13. A factory is producing 1000 high tensile fasteners per hour on a machine. The material cost is Rs. 375, labour cost is Rs. 245 and direct expense is Rs. 80. The factory oncost is 150 percent of the total labour cost and office oncost is 30 percent of the factory cost. If the selling price of each fastener is Rs. 1.30, calculate whether there is loss or gain and by what amount ?

14. A factory owner employed 50 workers during the month of November 2004, whose detailed expenditure is given below : (i) Material cost = Rs. 30,000 (ii) Rate of wage for each worker = Rs. 6 per hour (iii) Duration of work = 8 hours per day (iv) No. of holidays in the month = 5 (v) Total overhead expenses = Rs. 15,000 If the workers were paid over time of 400 hours at the rate of Rs. 12 per hour, calculate (a) Total cost, and (b) Man hour rate of overheads.

15. An isometric view of a work piece is shown in figure. What will be the weight of the material required to produce it. The density of material is 2.681 gm/cc. Find also the material cost if its rate is Rs.13.60 per kg. All dimensions are in mm.
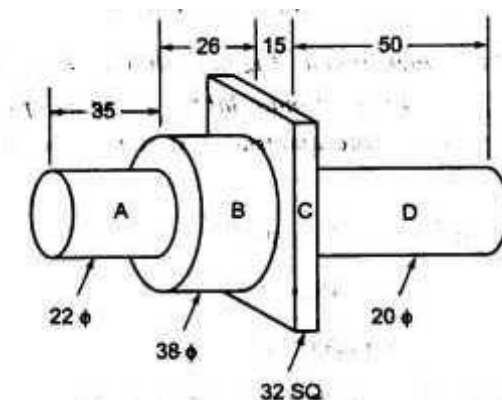
16. Estimate the weight of material required for manufacturing 220 pieces of shaft as shown in figure. The shafts are made of mild steel which weighs 7.87 gm/cm3 and costs Rs.4.25 per kg. Also calculate the material cost for 220 such shafts.
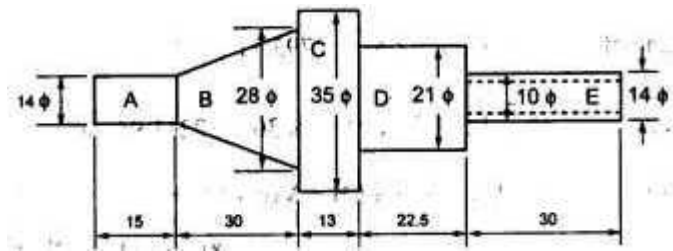


17. For manufacturing a 'milling machine', the expenditure is tabulated in table.

| S.No. | Particulars | Expenses in Rupees |
|---|---|---|
| 1. | Material consumed | 46,000 |
| 2. | Indirect factory wages | 7,000 |
| 3. | Director's fees | 2,500 |
| 4. | Advertising | 8,000 |
| 5. | Net profit | 11,750 |
| 6. | Depreciation on sales department's car | 900 |
| 7. | Printing and stationery | 350 |
| 8. | Depreciation on plant | 4,200 |
| 9. | Direct wages | 59,000 |
| 10. | Factory rent | 5,750 |
| 11. | Telephone and postal charges | 250 |
| 12. | Gas and electricity | 400 |
| 13. | Office salaries | 2,000 |
| 14. | Office rent | 600 |
| 15. | Showroom rent | 1,200 |
| 16. | Salesman's commission | 1,850 |
| 17. | Sales department car expenses | 1,200 |

Find out (a) Prime cost, (b) Factory cost, (c) Total cost of production, (d) Cost of sales, and (e) Selling price.

## UNIT-IV
### Part-A (2 Marks)

1. What is forging?

2. What are the constituents of a job estimate?

3. What are the components of cost?

4. Name the classification of miscellaneous allowance.

5. Give examples for overhead expenses.

6. What you mean by depreciation?

7. What are the losses in forging?

8. State machine hour rate.

9. What is shear loss?

10. What are the elements of forging cost?

11. Name some losses in foundry.

12. Define inadequacy.

13. Define flash loss.

14. What is fatigue allowance?

15. What is meant by direct labour cost?

16. State any four pattern allowance.

17. What are overheads?

18. What are all basis on which overheads are allocated?

19. What are the methods for allocation of overhead expenses?

20. What is administrative overhead?

## Part-B (16 Marks)

1. Two workers complete 20 connecting rods, each weighing 3.5 kg by forging per day. They are paid at the rate of Rs.16 and Rs.14 per day respectively. If the material cost is Rs.7.25/kg and 60% of the direct labour is required to compensate for the factory overheads, estimate the total cost of each rod.

2. A steel component shown in figure is to be drop forged in close impression dies. Estimate the gross weight of the component. The various losses account for 26 % of net weight. Take density as 7.7 gm/cc. (16)
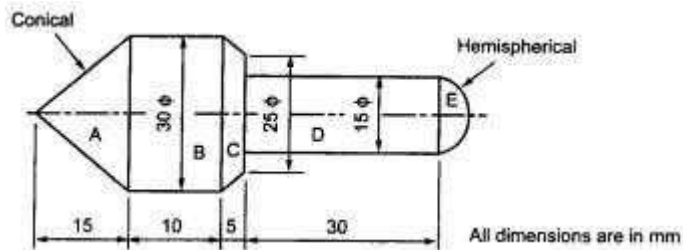
3. An open water tank of size 75 cm X 60 cm X 50 cm is made by gas welding from a 4 mm thick metallic sheet. Estimate the time required for welding a tank. Neglect other factors.
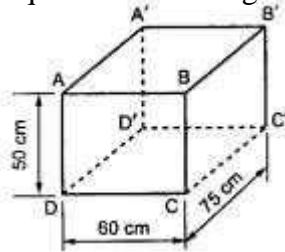


4. Estimate the material cost for welding 2 flat pieces of M.S. 15 X 16 1 cm size at an angle of 90° by gas welding Neglect edge preparation cost and assume: Cost O2 = Rs. 10/m3 Cost of C2 H2 = Rs.. 60/m2 Density of filler metal = 7 gm/cc Cost of filler metal = Rs. 12/kg filler rod dia = 5 mm filler rod required 4.5 m/m of welding assume O2 consumption = 0.7 cu.m/hr. C2H2 consumption = 0.5 cu.m/hr. Welding time = 30 min/m of welding. (16)
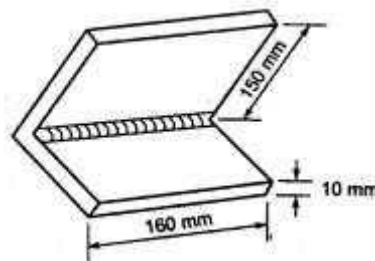


5. 20 numbers of gun metal bevel gear blank shown in figure are to be cast in the factory from the planner supplied by the customer Estimate the selling price of each piece from the following data.

        (i) Cost of molten gun metal= Rs.9.20 per kg. (3)

        (ii) Scrap return value = Rs.s 5.00 per kg. (3)

        (iii) Process scrap = 10 % net weight of casting (3).

        (iv) Administrative overheads=Rs.3.50 per kg (3).

        (v) Profit=15% of manufacturing cost. (2)

        (vi) Density of gun metal = 8.73 gm/cc .(2)
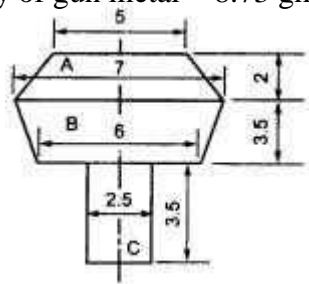
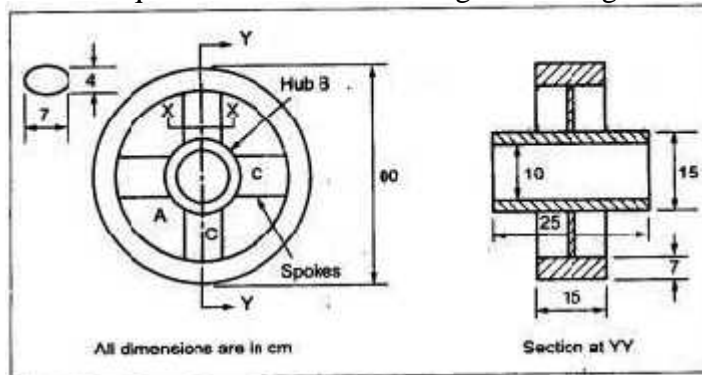6. An engine flywheel is required to be cast according to drawing shown in figure



Fig. 10.5.

(a) Estimate the net weight of the flywheel casting.
(b) Estimate the selling price of each wheel, given the following data :
   (i) Cost of pattern = Rs. 75 per 500 castings;
   (ii) Process scrap = 11% of net weight;
   (iii) Scrap return value = Rs. 0.70 per kg;
   (iv) Cost of molten metal at furnace spout = Rs. 2 per kg;
   (v) Administrative overheads = Rs. 6 per hour;
   (vi) Selling overheads = 25% of production cost;
   (vii) Profit = 15% of total cost;
   (viii) Density = 7.2 gm/cc.

Other expenditure detail are :

| Unit operation | Time per piece | Labour rate/hour | Shop overheads/hour |
|---|---|---|---|
| Moulding | 12 min | Rs. 2.75 | Rs. 4.50 |
| Pouring | 6 min | Rs. 2.50 | Rs. 3.50 |
| Shot blasting | 5 min | Rs. 2.60 | Rs. 4.00 |
| Fettling | 6 min | Rs. 2.40 | Rs. 3.25 |

7. A C.I. factory employees 25 persons It consumes material worth Rs. 35,000 pays workers at the rate of Rs. 5 per hour and incurs total overheads of Rs.20,000. In a particular month (25 days) workers and an overtime of 150 hours and were paid double than the normal rate. Find

   (i) The total cost, and

   (ii) The man hour rate of overheads. Assume 8 hours working days.

8. What are the various losses considered while calculating the material cost? Explain.

9. What are the elements considered while calculating the cost of welded joints?

10. Write the step by step procedure to estimate the cost of a cast component in the foundry shop.

11. Under what situations, you can use the allocation of overhead expenses by percentage on prime cost method.

12. A container open on one side of size 0.5 m × 0.5 m × 1 m is to be fabricated from 6 mm thick plates Fig. The plate metal weighs 8 gms/cc. If the joints are to be welded, make calculations for the cost of container. The relevant data is: Cost of plate = Rs. 10 per kg Sheet metal scarp (wastage) = 5 percent of material Cost of labour = 10 percent of sheet metal cost, Cost of welding material = Rs. 20 per meter of weld.
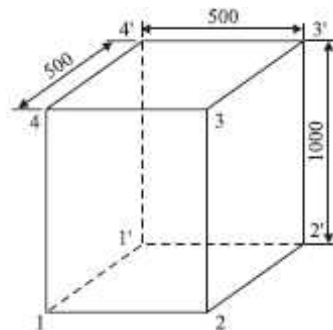


12. Calculate the net weight and gross weight for the component shown in Fig. Density of material used is 7.86 gm/cc. Also calculate: (i) Length of 14 mm dia bar required to forge one component. (ii) Cost of forging/piece if Material cost = Rs. 80 per kg labour cost = Rs. 5 per piece Overheads = 150 percent of labour cost.
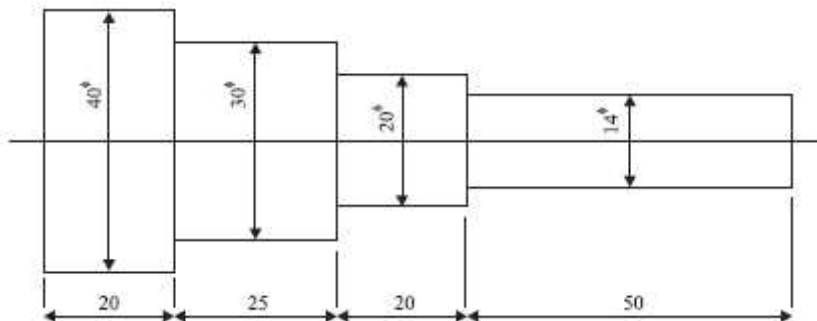
## Part-A (2 Marks)

1. What is machining time?
2. Define Length of cut.
3. Define feed.
4. What is meant by turning?
5. Define external relief turning
6. What is meant by chamfering?
7. Define facing.
8. Define knurling
9. Define drilling.
10. What are the various factors to b considered for selection of cutting speed?
11. What is milling? What are the operations that can be carried out on a milling machine?
12. What is grinding? Differentiate between surface and cylindrical grinding.
13. Define tapping.
14. What is meant by Approach length?
15. List the factors to be considered for the selection of feed and depth of cut for a particular operation.
16. Write the equation to calculate the turning time on lathe.
17. How to calculate the machining time calculation for thread operation?
18. How to estimate the milling time?
19. Write the formula for spot milling time.
20. How to estimate the grinding time?

## Part-B (16 Marks)

1. Calculate the machining time to turn the dimensions shown in Fig. 5.22. Starting from a m.s. bar of f 80 mm. The cutting speed with HSS tool is 60 meters per minute and feed is 0.70 mm / rev. depth of cut is 2.5 mm per pass.
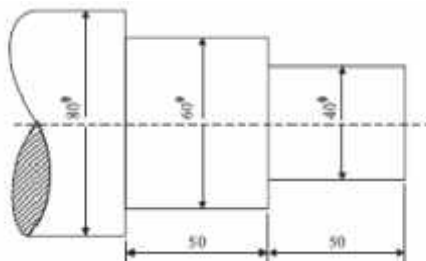
2. A mild steel bar 100 mm long and 38 mm in diameter is turned to 35 mm dia. And was again turned to a diameter of 32 mm over a length of 40 mm as shown in the Fig. 5.23. The bar was machined at both the ends to give a chamfer of 45° × 5 mm after facing. Calculate the machining time. Assume cutting speed of 60 m/min and feed 0.4 mm/rev. The depth of cut is not to exceed 3 mm in any operation.
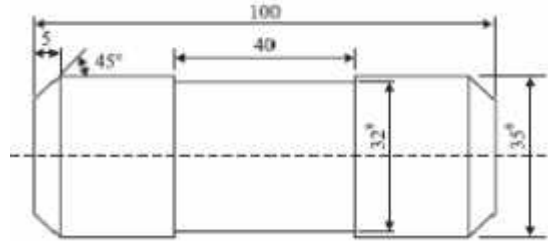


3. A mild steel shaft, shown in Fig. 5.24 is to be turned from a 24 mm diameter bar. The complete machining consists of the following steps: (i) Facing 24 mm f on both sides (ii) Turning to f 20 mm. Process Planning and Cost Estimation (iii) Drilling f 8 mm hole (iv) Knurling. With H.S.S tool the cutting speed is 60 m/min. The feed for longitudinal machining is 0.3 mm/rev. The feed for facing, 0.2 mm/rev., feed for knurling 0.3 mm/rev., and feed for drilling is 0.08 mm/rev. Depth of cut should not exceed 2.5 mm in any operation. Find the machining time to finish the job.
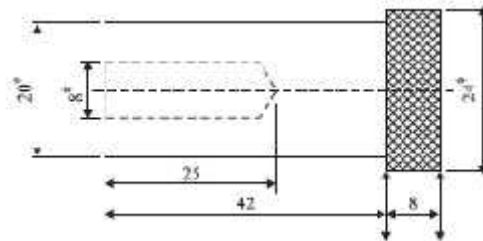


4. Calculate the machining time required to produce one piece of the component shown in Fig. starting from f 25 mm bar. The following data is available. For turning : Cutting speed = 40 m/min. Feed = 0.4 mm/rev. Depth of cut = 2.5 mm/per pass For thread cutting : Cutting speed = 8 m/min.
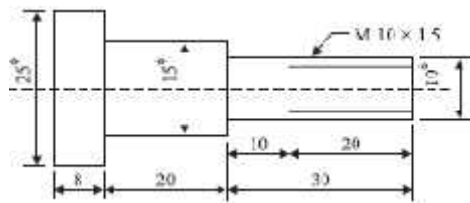


5. Estimate the time taken to drill a 25 mm dia × 10 cm deep hole in a casting. First a 10 mm dia drill is used and then the hole is enlarged by a 25 mm dia drill. Assume : Cutting speed = 15 m/min. Feed for f 10 mm drill = 0.22 mm/rev. Feed for f 25 mm drill = 0.35 mm/rev.

6. Calculate the time required to tap a hole with 25 mm diameter 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.

7. A 300 mm × 50 mm rectangular cast iron piece is to be face milled with a carbide cutter. The cutting speed and feed are 50 m/min and 50 mm/min. If the cutter dia is 80 mm and it has 12 cutting teeth, determine : (i) Cutter r.p.m. (ii) Feed per tooth (iii) Milling time.

8. Find 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 cuts are required, one roughing cut with cross feed of 2 mm per stroke and one finishing cut with feed of 1 mm per stroke.

9. 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. Calculate the time required to grind the job assuming work speed of 12 m/min and depth of cut 0.02 mm per pass.

10. Explain the procedure of estimating the machining cost per piece in machining large number of bolts on a turret lathe.

11. Describe the procedure of estimating the machining time required during shaping

12. How can you estimate the grinding time for a cylindrical grinding operation.