# BITS Pilani
Dubai Campus

## FIRST SEMESTER 2013- 2014

III Year Mechanical ME F313 Production Techniques II Compre Date: 29.12.13
Weightage: 35% Marks: 70 Time: 3h

**Answer all questions**

**Part A (7x4=28 Marks)**

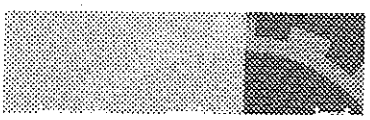
1. Construct the flow line layout for Group Technology
2. Explain the working principle of laminated object manufacturing with a sketch
3. With a neat sketch, explain the terminology for surface texture
4. With a flow chart, briefly explain the principle of retrieval CAPP system
5. Describe the principle of ultrasonic machining with a sketch
6. With a neat sketch, explain the working principle of Laser beam machining
7. Derive an expression for optimum cutting speed for minimizing production time.

**Part B (6x7=42 Marks)**

1. The cutting force and thrust force in an orthogonal cutting operation are 1500N and 1600N, respectively. The rake angle = 6®, the width of the cut = 5.0 mm, the chip thickness before the cut = 0.7, and the chip thickness ratio =0.4. Determine (a) the shear strength of the work material and (b) the coefficient of friction in the operation.

2. A drilling operation is to be performed with a 14 mm diameter twist drill in a steel work part. The hole is a blind hole at a depth of 65 mm and the point angle is 116®. The cutting speed is 30 m/min and the feed rate is 0.35 mm/rev. Determine (a) the cutting time to complete the drilling operation and (b) metal removal rate during the operation.

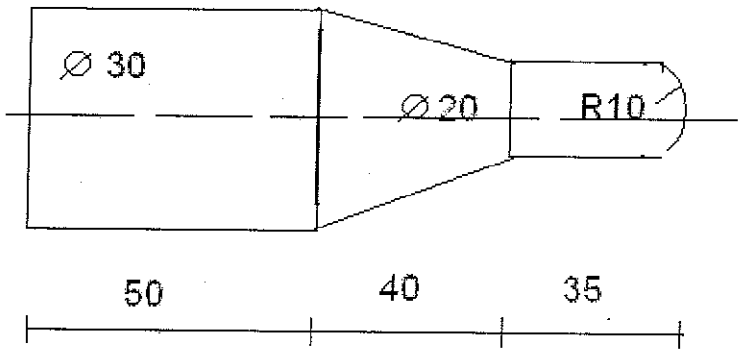
3. Tool life tests on a lathe have resulted in the following data: (a) At a cutting speed of 112.5 m/min; the tool life was 6 min; (b) at a cutting speed of 82.5 m/min the tool life was 55 min. (i) Determine the parameters $n$ and $C$ in the Taylor tool life equation. (ii) Based on the $n$ and $C$ values, what is the likely tool material used in this operation? (iii) Using your equation, compute the tool life that corresponds to a cutting speed of 90 m/min (iv) Compute the cutting speed that corresponds to a tool life $T$ = 10min.



4. For EDM, determine discharge time if $V_o$ = 110 V and $V_d^*$ = 16 V. Spark energy = $6 \times 10^{-4}$ kJ. Generator is expected for maximum power during charging. Machine resistance = 0.55 Ω.

5. Material removal rate in AJM is 0.6 $mm^3$ /s. Calculate (i) material removal per impact if mass flow rate of abrasive is 3.5 gm/min, density is 3.5 gm/cc and grit size is 65 µm (ii) indentation radius. The indentation is assumed to be hemispherical.

6. Write the part program for the following job to be machined in lathe.
*All dimensions are in mm*




*Some formulae for NTM*

$$V_c^* = 0.716 V_o \qquad E_s = \frac{1}{2} C V^2 \qquad f = \frac{1}{t_c + t_d} \qquad t_d = -\frac{R_m C}{\ln\left(\frac{V_d^*}{V_c^*}\right)}$$

$$\text{Mass of grit} = \frac{\pi}{6} d_g^{\,3} \rho_g \qquad \text{No. of impact / time} = \frac{m_g}{\frac{\pi}{6} d_g^{\,3} \rho_g}$$

Indentation Volume = $\Gamma_g = \frac{MRR}{N}$

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## FIRST SEMESTER 2013- 2014

O/L

III Year Mechanical ME F313 Production Techniques II Test 2 Date: 10.12.13
Weightage: 15% Marks: 30 Time: 50 min.

**Answer all questions**

| | | |
|---|---|---|
| Q1 | A LBM set up with a power intensity of $2x10^5$ W/mm$^2$ is used to drill a 0.2mm diameter hole in tungsten sheet of 0.4mm thickness. If the efficiency is 10% estimate the time required. The energy required to vapourize tungsten is $3x10^4$ J/cm$^3$ | 6 |
| Q2 | You have to machine a right angle triangle triangular slot with base 60mm and height 40mm from a 85mmx75mmx20mm steel block using wire EDM, Determine time for machining if the diameter of wire is 3mm and spark gap is 1mm. The velocity of machining is 2mm/s. | 6 |
| Q3 | Composition of a Muntz metal used in ECM is as follows:<br>Cu = 60.0%, Zn = 38.0%, Fe = 2.0%<br>Calculate rate of dissolution if the area of the tool is 1000 mm$^2$ and a current of 2000 A is being passed through the cell. Assume dissolution to take place at lowest valence of the elements. (F=96500 coulomb)<br>Note: Use the values given in the table below. | 6 |
| Q4 | Glass is being machined at a MRR of 6 mm$^3$ /min using USM. The amplitude of vibration is increased by 50% and the flow strength of work material is decreased by 25%. Determine the MRR. | 6 |
| Q5 | The tool life equation derived for a machining condition is as follows: $V f^{0.3} T^{0.4}=30$ The nose radius of the tool is 0.5mm and the surface roughness average value is 10μm. The cost for labour and overheads is 0.5$/min and the total regrinding cost is 3$ and the time for changing the tool is 3min. Determine the most productive speed. | 6 |

| Metal | Gram atomic weight | Valency of dissolution | Density (g/cm$^3$) |
|---|---|---|---|
| Aluminium | 26.97 | 3 | 2.67 |
| Chromium | 51.99 | 2/3/6 | 7.19 |
| Cobalt | 58.93 | 2/3 | 8.85 |
| Copper | 63.57 | 1/2 | 8.96 |
| Iron | 55.85 | 2/3 | 7.86 |
| Nickel | 58.71 | 2/3 | 8.90 |
| Tin | 118.69 | 2/4 | 7.30 |
| Titanium | 47.9 | 3/4 | 4.51 |
| Tungsten | 183.85 | 6/8 | 19.3 |
| Zinc | 65.37 | 2 | 7.13 |
| Silicon | 28.09 | 4 | 2.33 |
| Manganese | 54.94 | 2/4/6/7 | 7.43 |

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# FIRST SEMESTER 2013- 2014

III Year Mechanical ME F313 Production Techniques II Test 1 Date: 20.10.13
Weightage: 15% Marks: 30 Time: 50 min.

**Answer all questions**

Q1 Consider the following data related to orthogonal machining in lathe. Diameter of the work piece =30mm; spindle speed = 500rpm; rake angle = 10°; feed rate = 0.5mm /rev; depth of cut =2mm; chip thickness =0.9mm; shear strength of the work material=300MPa. Construct the Merchant's circle and determine the cutting forces. **5**

Q2 Construct the velocity diagram for the data given in Q1 and determine the different velocities. **5**

Q3 The following data are available for face milling operation: Cutter diameter = 100mm; Width of the work piece = 150mm; Depth of cut = 2mm; Rotational speed of the cutter = 300rpm; Length of work piece = 500mm and feed = 0.5mm/s; specific energy of the work material = 3 W-s/mm$^3$. Determine the Time for machining, MRR, Power and Cutting force developed when the face milling cutter is passed with an offset of 5mm from one side. **5**

Q4 Derive relationships for ~~approach distance~~ the following ~~operations~~ using sketch: Approach distance for slab milling & Over distance for drilling **5**

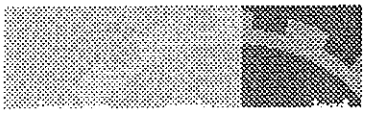
Q5 a. With a simple sketch, briefly explain the counter sinking operation in drilling machine **2**

b. Mention any four common milling operations. **2**

c. Mention two materials each for conventional and super abrasives used in grinding **2**

d. How will you calculate cutting velocity in shaper? **2**

e. List the parameters used for specification of a lathe. **2**



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## FIRST SEMESTER 2013- 2014

III Year Mechanical ME F313 Production Techniques II Quiz 2 Date: 11.11.13
Weightage: 5% Marks: 10 Time: 20 min.

**Name:** **ID.No.:**

**Answer all questions**

| | | |
|---|---|---|
| Q1 | Define lip angle in drill bit | 1 |
| Q2 | Briefly explain how the automatic feed motion is achieved in lathe? | 1 |
| Q3 | Write the expression to calculate the tool changing cost. | 1 |
| Q4 | Construct the graph showing the effect of various costs associated with machining | 1 |
| Q5 | How will you adjust the stroke length and position of stroke in shaper? | 1 |

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## First Semester 2013 - 2014
## Course: ME F313 Production Techniques II
## QUIZ- 1[ Closed book]

**Max.Marks :10** **Date:30.09.2013**
**Weightage: 5 %** **Time: 20 min**

1. The chip thickness before the cut and shear plane angle are 0.3 mm and $33^0$ respectively. If the rake angle of tool is $5^0$, find the chip thickness after the cut. [2]

2. The cutting force and thrust force in the machining process are 4500 N and 3000 N respectively. If the shear plane angle is $40^0$ and shear area is 20 $mm^2$, find the shear stress? [2]

3. Calculate the shear strain value for a machining process using tool with rake angle of $10^0$ and a shear plane angle of $43^0$? [2]

4. Tool life tests in turning give the following data: (i) when cutting speed is 100 m/min, tool life is 10 min; (ii) when cutting speed is 75 m/min, tool life is 30 min. (a) Determine the n and C values in the Taylor tool life equation. [2]

5. Construct the velocity diagram for orthogonal cutting [2]