**BITS PILANI, DUBAI CAMPUS**
**Dubai International Academic City, Dubai**
**First Semester 2011-2012**

III Year Mechanical
MEC 342 Production Techniques
Date: 11-01-2012
Time: 3 Hrs.

Comprehensive Examination
Weightage: 35%
Marks : 70

| # | **Answer all questions**<br>**Assume suitable data, if required**<br>**Answer the questions sequentially** |
|---|---|
| | **Part I (5x5=25 Marks)** |
| 1 | With schematic sketches, explain the following: |
| a. | Working principle of Electron beam machining process |
| b. | Mechanisms of sintering |
| c. | Production of fiber reinforced plastic sheets |
| d. | Stages of glass bottle manufacturing |
| e. | Stud welding process |
| | **Part II (3x5=15Marks)** |
| 2 | True strain is equal to strain hardening exponent at necking. Prove this using a derivation. |
| 3 | Derive an expression for mould filling time in bottom gating. |
| 4 | Derive an expression for maximum reduction per pass in drawing operation |
| | **Part III (5x6=30 Marks)** |
| 5 | A steel disc with a diameter of 20cm and height 5cm is manufactured through sand casting. Shrinkage is assumed to be 4% for the material used. Determine the diameter and height of the cylindrical riser for sound casting. |
| 6 | A steel casting has a cylindrical geometry with 105 mm diameter and weighs 9.8 kg. This casting takes 5.8 min to completely solidify. Another cylindrical-shaped casting with the same diameter-to-length ratio weighs 5.6 kg. This casting is made of the same steel, and the same conditions of mold and pouring were used. The density of steel = 7840kg/m$^3$. Determine (a) the mold constant in Chvorinov's Rule, (b) the dimensions, and (c) the total solidification time of the lighter casting. |

| | |
|---|---|
| 7 | Rod stock is drawn through a die with an entrance angle of $15^{o}$. The starting and final diameters are 30 mm and 25mm respectively. The coefficient of friction between the work piece and die is 0.3. In the flow curve of the work metal, K = 500MPa and n = 0.25. Determine: (i) area reduction; (ii) force for the drawing operation; and (iii) horse-power to perform the operation if the stock exit velocity is 0.6m/s. |
| 8 | A slab milling operation is performed on the top surface of a plate, which is 300mm long and 100mm wide. The milling cutter, which is 75mm in diameter, has 5 teeth. Cutting conditions are speed spindle of 80m/min, the depth of cut is 8mm, and the feed is 0.2mm/revolution. The milling cutter is to overhang the width of the work-piece on both sides. Determine: (i) the milling time for one pass across the surface; and (ii) the material removal rate during the milling operation. |
| 9 | A material removal rate of 500 $mm^3$/min is required in electro chemical machining. Determine the current required for the operation if the work-piece density is 7.86g/cc. Atomic weight and valency of steel are 56amu and 2. Faradays constant is 96500C. |

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**First Semester 2011-2012**

III Year Mechanical
ME C342 Production Techniques — Test 2 Open book
Date: 18-12-2011 — Weightage: 15%
Time: 50 min. — Marks: 30

| # | 1. Answer all the questions<br>2. Assume suitable data, if required<br>3. Test books and hand written class notes are permitted | Marks |
|---|---|---|
| 1 | Derive expressions for<br>(i) forces along shear plane and<br>(ii) chip velocity<br>using illustrations | 6 |
| 2 | A cylindrical work-piece has an initial diameter of 50mm. The initial height is equal to 80mm and is upset forged in an open die to a diameter of 65mm. Coefficient of friction at the die-work interface = 0.3. n=0.2 and K = 317 MPa. Determine:<br>(i) final height of the part<br>(ii) maximum force required | 6 |
| 3 | A rolling mill reduces the thickness of a 75mm-thick plate, to 45mm in one pass. Roll radius is 300mm, rotational speed is 10 revolutions per minute, and entrance speed is 15m/min assuming negligible spread along width. Determine:<br>(i) the coefficient of friction corresponding to maximum draft<br>(ii) exit velocity and<br>(iii) forward slip | 6 |
| 4 | Bending operation is to be performed on a 3 mm-thick cold-rolled steel. The width is 30 mm. It is to have a bent portion having a radius of 5 mm with a bending angle of $60^{o}$. The tensile strength of the material = 650MPa and E = 200 GPa. Determine:<br>(i) Bending allowance and<br>(ii) Radius after bending due to elastic recovery | 6 |
| 5 | Machining tests have resulted in 1.5min tool life for cutting speed v = 5.0m/s and a 15min tool life at a cutting speed of v = 3.0m/s. Determine:<br>(i) the constants in the Taylor equation;<br>(ii) how long the tool would last at a speed of 1.5m/s. | 6 |

**BITS PILANI, DUBAI CAMPUS**
**DUBAI INTERNATIONAL ACADEMIC CITY, DUBAI**
First Semester 2011-2012

III Year Mechanical
ME C342 Production Techniques
Date: 23-10-2011
Time: 50 min.

Test 1
Weightage: 15%
Marks: 30

| # | 1. Answer all the questions<br>2. Assume suitable data, if required | Marks |
|---|---|---|
| 1 | Describe the following processes with neat sketches.<br>a. Vacuum casting<br>b. Shell moulding | 6 |
| 2 | Derive the condition to avoid aspiration effect through design of sprue | 6 |
| 3 | A cylindrical riser is to be designed for a sand casting mold. The length of the cylinder is to be 1.25 times its diameter. The casting is a square plate, each side = 10 cm and thickness = 2 cm. If the metal is cast iron, and the mold constant = 3.0 min/cm$^2$ in Chvorinov's Rule, determine the dimensions of the riser if the solidification time is 30% more than that of casting. | 6 |
| 4 | Molten metal can be poured into the pouring cup of a sand mold at a steady rate of 1000 cm$^3$/s to fill a spherical mould with 10cm radius. The molten metal overflows the pouring cup and flows into the down sprue. The cross-section of the sprue is round, with a diameter at the top = 3.4 cm. If the sprue is 25 cm long, determine the proper diameter at its base so as to maintain the same volume flow rate. Also, determine the time required for mold filling. | 6 |
| 5 | Torsion test was conducted on a steel tube with shear modulus of 120GPa. The average radius and the length of the specimen were 25mm and 250mm respectively. Find the thickness of the tube, if the twist is 0.05radians and the applied torque is 1500 N-m. | 6 |

# BITS PILANI, DUBAI CAMPUS
## Dubai International Academic City, Dubai
**First Semester 2011-2012**

**III Year Mechanical**

**MEC 342 Production Techniques** **Quiz 2** **A**

**Date: 07-12-11** **Weightage: 5%** **Time: 20 min.**

Name: ID No.:

| | | |
|---|---|---|
| 1 | With a simple sketch briefly explain the hydrostatic extrusion process | 2M |
| 2 | With a simple sketch explain the parts of a drawing die. | 2M |
| 3 | List the selection factors for press selection for forging | 2M |
| 4 | The following data are available for direct extrusion: Velocity of ram = 0.01m/s, Diameter = 25mm, Length =50mm, K = 150 MPa, n = 0.15, a =0.8 and b = 1.5. Determine the force and power required for an extrusion ratio of 4. | 4M |

# BITS PILANI, DUBAI CAMPUS
## Dubai International Academic City, Dubai
### First Semester 2011-2012

III Year Mechanical

MEC 342 Production Techniques | Quiz 1 | **A**

**Date: 28-09-2011** | **Weightage: 5%** | **Time: 20 min.**

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

1. How will you determine the resilence of a material using stress-strain curve? (Sketch & Equation) [1]
2. What is a creep failure? How will you determine the creep rate graphically?[1]
3. What is the difference between trans-granular fracture and inter-granular fracture?[1]
4. Show the progression stages of ductile fracture in a tensile specimen. [1]
5. How will you determine the endurance limit of a ferrous alloy? (Sketch) [1]
6. The following equation is related to the flow behavior of a material.

   $250\varepsilon^{0.6}$MPa

   Calculate the true and engineering ultimate tensile strength values. [5]