BITS, PILANI – DUBAI

First Semester 2009-2010

III Year Mechanical
MEC 342 Production Techniques — **Comprehensive Examination**
Date: 28-12-09 — **Weightage: 35%**
Time: 3 Hrs. — **Marks: 70**

Answer all the Questions
Assume suitable data, if required.

SNo.		Marks
	Part A (5X5=25 Marks)	
1	Describe the investment casting process with suitable sketch	5
2	Explain the different rolling defects with simple sketch	5
3	Describe the pultrusion technique for manufacturing of fibre reinforced plastics	5
4	Explain the stages in manufacturing of powder metallurgy components with a flow chart.	5
5	Describe the stages in manufacturing of glass bottle with suitable sketch.	5
	Part B (5X2=10 Marks)	
6	What is hot isostatic pressing? Mention its advantage.	2
7	Define slip used in manufacturing of ceramics. List the stages in slip casting.	2
8	What do you mean by jiggering in ceramic manufacturing? Show a sketch for the operation.	2
9	Name the techniques used for strengthening of glass. Define any one of them.	2
10	Define ironing in deep drawing. What is the condition in terms of anisotropy to avoid ironing?	2
	Part C (5X7=35 Marks)	
11	The data related to turning operation is given as follows: Depth of cut = 1.5mm; Feed rate =0.2 mm/rev; Rake angle =12°; Friction angle = 30°; Shear strength of the work material = 350MPa; Construct the Merchant's circle using the given data and estimate the force components.	7

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12	a. The following data is related to an orthogonal machining. Feed rate=0.2mm/rev and Nose radius = 0.8mm. Determine the expected surface roughness value.	3
	b. A cutting tool follows Taylor's tool life equation with n=0.5 and C=300. Calculate the decrease of tool life if the cutting speed is increased by 50%.	4
13	The data related to plain milling operation is given below: Length of the specimen=50mm; width of the specimen =10mm; feed / tooth = 0.05mm/tooth; depth of cut =0.5mm; Diameter of the cutter = 5mm; Number of teeth =20 and Speed = 100 rpm. Find the velocity of work piece, MRR, power, torque and time of machining	7
14	The following data is related to Abrasive Water Jet Machining process. Transverse speed = 350 mm/min; Insert diameter = 1mm; Specific energy for cutting = 13.6 J/mm^3; Orifice diameter = 0.3mm.; Mass flow rate of abrasive= 1 kg/min; Water jet velocity = 850 m/s and Pressure = 4000 bar. Determine the depth of penetration.	7
15	For an electro chemical machining operation, the following data are available. MRR = 600mm^3/min, Atomic weight = 56; Valence = 2; Faraday's constant = 96500C; Density of material = 7.8 g/cc. Estimate the current required.	7

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III Year Mechanical
MEC 342 Production Techniques
Date: 13-12-09
Time: 50 min.

Test 2 (Open book)
Weightage: 15%
Marks: 5x6 =30

- **Answer all the Questions**
- **Assume suitable data, if required.**
- **Text books and hand written class notes are permitted**

SNo.		Marks
1	In forging a solid cylindrical work piece of AISI steel, that is 35cm high and 50cm diameter and is to be reduced by 30%. Let the friction coefficient be 0.2. The work material has a strength coefficient of 530 MPa and strain hardening exponent of 0.26. Calculate the forging force required using slab method. What would be the final shape after forging (rough sketch)?	[6]
2	An AISI steel 1020 carbon steel strip 400mm wide and 10mm thick, rolled to a thickness of 7mm. The roll radius is 200mm and it rotates at 200 rpm. The work material has a strength coefficient of 530 MPa and strain hardening exponent of 0.26. Determine the true strain, average flow stress and the rolling force. If the rolling machine of total 200kW is available, can this machine perform the job?	[6]
3	A 50mm diameter rod will be drawn to a final 25mm diameter product. How many passes are required to achieve the final diameter if the material is perfectly plastic? What is the smallest diameter can be drawn in one pass if the strain hardening coefficient is 0.12?	[6]
4	A sheet steel is bent to a radius of 25mm. Assuming the yield stress is 275 MPa. Youngs modulus is 70GPa and thickness is 0.5mm. Calculate the radius of the part after spring back. Find the minimum bend radius if the material percent reduction of area is 20%.	[6]
5	10mm dia circular grids were drawn over the low carbon steel sheet metal and it was subjected to deep drawing. The change in dimensions of grids along x and y axes for the selected positions are given in table T5. Comment on the formability of the material.	[6]

Horizontal, mm	8	11	12	7
Vertical, mm	12	14	13	15

Table. T5

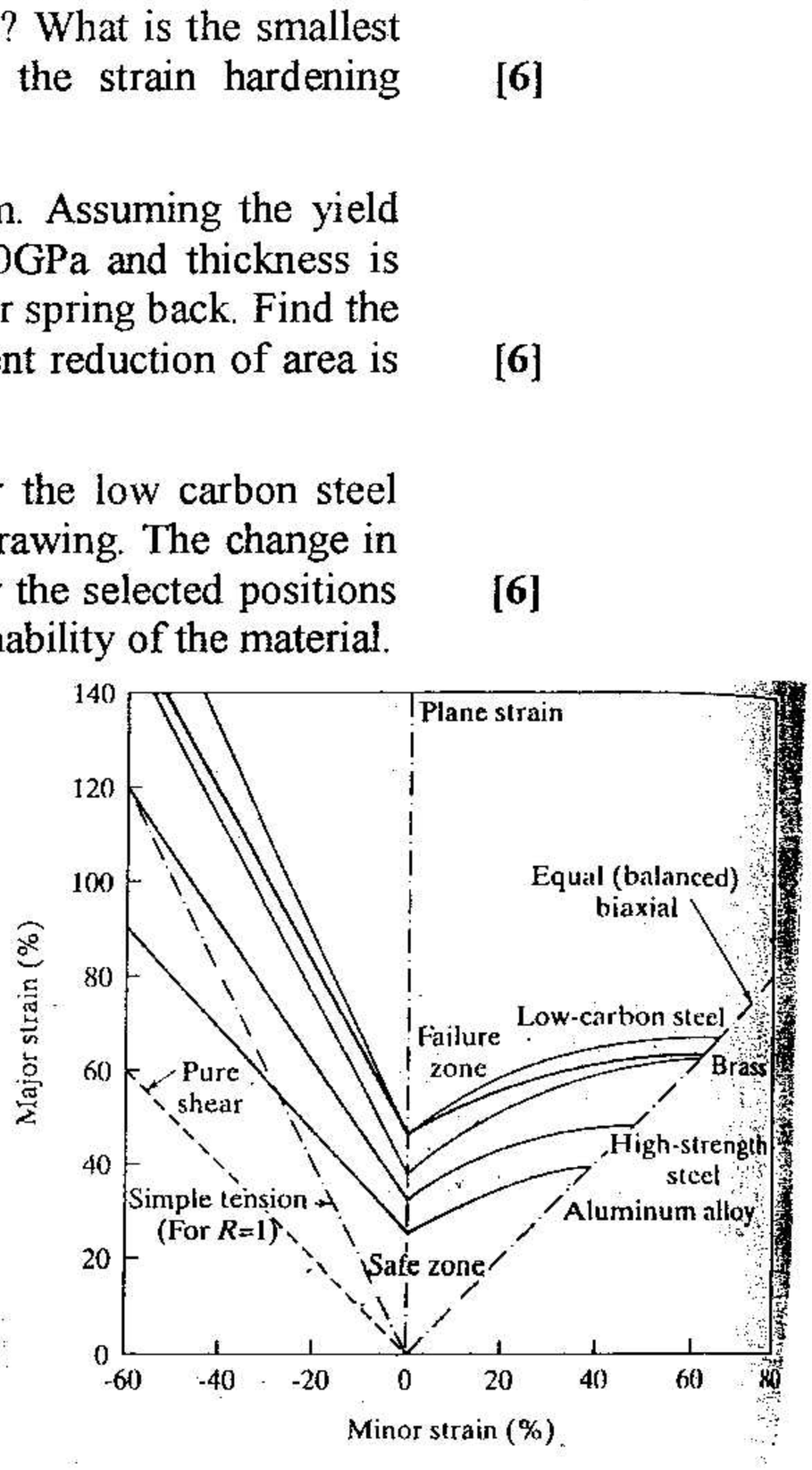

Fig. Q5

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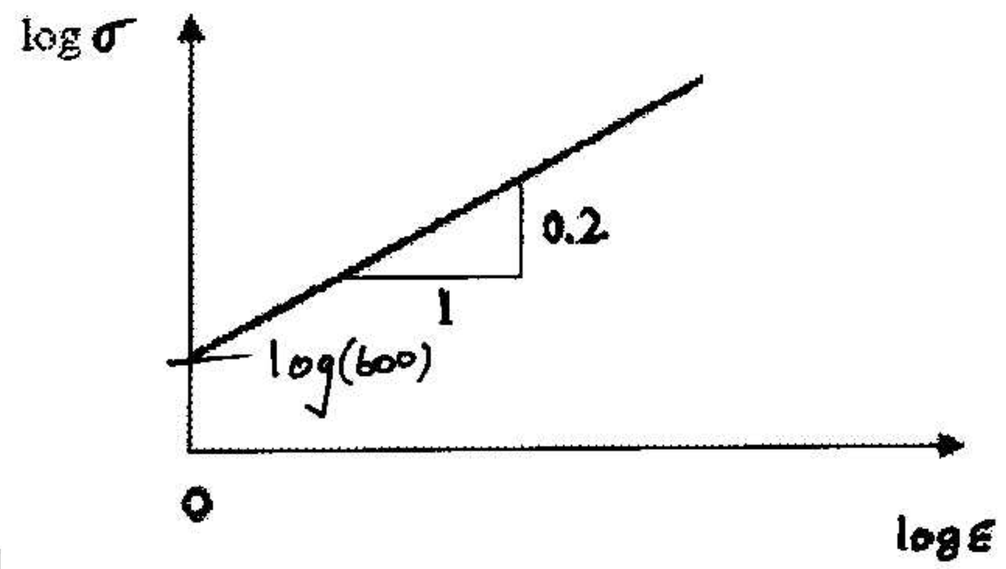
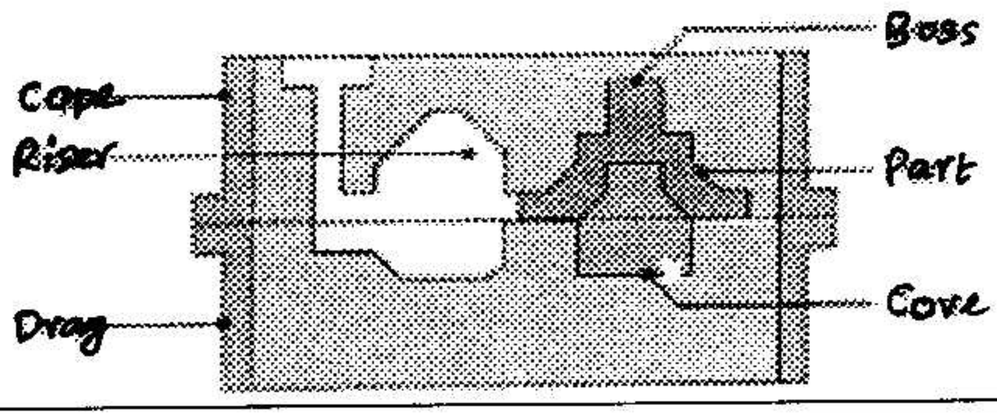
First Semester 2009-2010

III Year Mechanical
MEC 342 Production Techniques
Date: 25-10-09
Time: 50 min.

Test 1
Weightage: 15%
Marks: 5x6 =30

#		Marks
1	A cable material behaves according to $\sigma = K\varepsilon^{n}$ (MPa). A log plot is given as below. (Fig. Q1) **(a)** Find K, n **(b)** If the original cross section area is 5 mm^2, find the maximum tensile force that this cable can withstand prior to necking.  **Fig. Q1**	[6]
2	The design specification for a metal requires a minimum hardness of 75HRA. If a Rockwell test is performed and the penetration is 75μm, is material acceptable?	[6]
3	The cylindrical riser design is optimum when the top surface is hemispherical to ensure that it cools more slowly than the casting it feeds. Compare the solidification time of the optimum riser to that of a riser shaped like a right circular cylinder. Assume that the volume of each riser is the same and that, for each, the height is equal to the diameter.	[6]
4	A down sprue leading to the runner of a mould has a length of 200mm and area of cross section of $400mm^2$. The mould cavity has a volume of $0.002m^3$. Determine **(a).** the velocity of the molten metal through sprue **(b).** volume flow rate of the metal and **(c).** mould filling time	[6]
5	Porosity is developed in the boss of the casting illustrated in the figure below. Show that by simply repositioning along parting line of this casting, the problem can be eliminated. **(use rough sketch)**  **Fig. Q5**	[6]

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First Semester 2009-2010

III Year Mechanical

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

Marks: 10 **(5% weightage)** **Time: 20 min.**

Name: **ID No.:** **Date:** 25.11.09

1. Construct a formability limit diagram and show the different parts [1]
2. With the use of sketch, differentiate the residual stresses for larger and smaller rollers. [1]
3. Explain briefly the variation of velocity components in rolling and define neutral point. [1]
4. What is hydrostatic extrusion? List the advantages.[1]
5. Specify the defects and causes for forging operation. [1]
6. List the sequence of operations involved in making PEPSI can. [1]
7. With a simple sketch, specify the different components of extrusion die. [2]
8. With a simple sketch, specify the different parts of a drawing die. [2]

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Second Semester 2008-2009

III Year Mechanical

MEC 342 Production Techniques **Quiz 1**

Marks: 5x2 =10 **Time: 20 min.**

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

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1. Specify the shape of the indenters used in Brinell, Vicker, Knoop and Rockwell Hardness testers.
2. Differentiate blow, scar and blister with suitable sketches.
3. Compare aluminium and steel on the basis of endurance limit with a simple sketch.
4. With a simple sketch briefly explain the uses of skim bob and choke.
5. The engineering stress vs. strain curve from a tension test is shown as below (a) Sketch the true stress vs. true strain curve. (b) Label the position where necking occurs on the appropriate stress vs. strain curve. (c) What is the load characteristic at necking?