

**College of Engineering, Pune-5**  
(An autonomous Institute of Government of Maharashtra)

**SY B. Tech- Metallurgy**

**End Semester Examination – Autumn Term**

**MT201- STRUCTURE AND PROPERTIES OF MATERIALS**

Date- 12 Nov 2010

Time 10 AM to 1 PM

Academic Year: 2009- 10

Marks: 50

**Instructions:**

1. All Questions are compulsory
2. Draw neat figures wherever required
3. Figures to the right indicate full marks

- Q1. Write the statement is true or false and justify your answer. 15
- a) Magnesium oxide a ceramic material having ionic bonding.
  - b) In compression test, as length to diameter ratio increase compressive strength decreases.
  - c) Planar growth is faster than dendritic growth in solidification.
  - d) Impact strength increase as temperature of material increases.
  - e) In 70/30 brass, hardness of beta phase can be calculated by Micro hardness test.
- Q2. 4
- Explain with proper example Fick's second law of diffusion
- Q3. Differentiate between (any four) 16
- a. Resilience and toughness
  - b. Rockwell hardness test and Rockwell superficial hardness test
  - c. Tensile test and bend test for brittle materials
  - d. Planar growth and dendritic growth mechanism in solidification.
  - e. Radiography and ultrasonic tests in NDT
- Q4. Draw self explanatory diagrams of following 15
- a. Screw dislocation & Edge Dislocation
  - b. Small and high angle grain boundary
  - c. Engineering & True - Stress strain diagram
  - d. HCP and FCC crystal structure
  - e. Tilt boundary and twin boundary

**College of Engineering, Pune**  
(An Autonomous Institute of Government of Maharashtra)  
**END SEMESTER EXAMINATION**  
**(MT202) PRINCIPLES OF PHYSICAL METALLURGY**  
**Semester – I**

Year: S.Y.B-Tech

Academic Year: 2010-11

Duration: 3 hrs.

Branch: Metallurgy

Date: November 18, 2010

Max. Marks: 50

**Instruction to candidates:**

1. All questions are compulsory.
2. Neat Diagrams must be drawn wherever necessary.
3. Assume suitable data, if necessary.

Q.1		Solve any <i>two</i> :	
	a.	Give chemical composition of following steels: i. 40Cr1Mo28    ii. 55Mn75    iii. 30C5    iv. T105Cr1Mn60    v. AISI2320	[5]
	b.	Comment on : i. Mechanical properties of steel are dependent on microstructure. ii. Tempering is carried out immediately after hardening.	[5]
	c.	Thin pieces of 0.3 mm thick strips of AISI 1080 steel are heated for 1 hour at 850 <sup>0</sup> C and then given the heat treatments shown in the following list. Using isothermal transformation (IT) diagram, determine the microstructures of the samples after each heat treatment: i. Water quench to room temperature ii. Quench in molten salt bath at 690 <sup>0</sup> C and hold for 3 hours and water quench iii. Quench to 580 <sup>0</sup> C hold for 20 minutes and then water quench. iv. Quench to 450 <sup>0</sup> C and hold for 5 hr and water quench. Also define the term CCR.	[5]
Q.2	a.	Differentiate between annealing and normalizing.	[5]
	b.	Draw the self explanatory sketches of austenite to pearlite transformation. State the characteristics of martensitic transformation.	[5]
Q.3	a.	Explain the mechanism of quenching in detail. Arrange any four quenching mediums according to their severity of quench.	[5]
	b.	Define the term hardenability. How hardenability is measured? State the factors affecting the hardenability of steel.	[5]
Q.4	a.	What is carbon equivalent? What is its significance?	[2]
	b.	Name two graphite former and two carbide former elements.	[2]
	c.	What is mean by term growth and fire cracks used in cast irons? State the methods to overcome these problems.	[2]
	d.	What is the role of nodulizing element in production of SGCI?	[2]

	e.	Why grey cast iron is used for machine beds?	[2]
Q.5		Solve any <i>two</i> :	
	a.	Suggest suitable copper base alloy for following applications and give its chemical composition: i. Cartridge cases    ii. Statues    iii. Bell    iv. Imitation jewellery    v. Brazing	[5]
	b.	In the eutectic alloy system A-B, the composition of three conjugate phases of the eutectic are $\alpha = 15\%B$ , $L = 75\%B$ and $\beta = 95\%B$ . Assuming equilibrium freezing of an alloy composed 50%A and 50%B just below the eutectic temperature, calculate : i. The percentage of proeutectic alpha ii. The percentage of eutectic alpha.	[5]
	c.	What are the requirements of a journal bearing? How are these fulfilled in practice?	[5]
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COLLEGE OF ENGINEERING, PUNE  
(Autonomous Institute of Govt. of Maharashtra)

END SEMESTER EXAM

Subject: Mechanical Technology (ME213)

Dept: Metallurgy and Material Science

Year: S.Y.B.Tech

Date: 20/11/2010

Time: 3 hrs

Max Marks: 50

Instructions:

- Use of scientific calculators is permitted.
- All questions are compulsory.
- Assume suitable data wherever necessary.

- Q1 a) A four stroke cycle gasoline engine has six single acting cylinders of 8cm bore and 10cm stroke. The engine is coupled to a brake having a torque radius of 40cm at 3200 rpm, with all cylinders operating the net brake load is 350N. When each cylinder in turn is rendered inoperative, the average net brake load produced at the same speed by the remaining 5 cylinders is 250N. Estimate the indicated mean effective pressure of the engine. With all cylinders operating the fuel consumption is 0.33kg/min; Calorific value of fuel is 43MJ/kg; the cooling water flow rate and temperature rise is 70kg/min and 10°C respectively. On test, the engine is enclosed in a thermally and acoustically insulated box through which the output drive, water, fuel, air and the exhaust connections pass. Ventilating air blown up through the box at the rate of 15kg/min enters at 17°C and leaves at 62°C. Draw up a heat balance of the engine stating the items as a percentage of the heat input. 4
- b) With the help of a neat sketch explain the working of Babcock Wilcox Boiler. Draw a neat sketch of any one type of Mounting. 4
- Q2 a) Steam issues from the nozzles of a De-Laval turbine at a velocity of 1000 m/s at an angle of 20°. The blade velocity is 300 m/s and the blades are symmetrical. The mass flow rate is 0.5 kg/s. Allowing a friction factor of 0.8, determine: 4
- blade efficiency,
  - power developed and,
  - stage efficiency if the nozzle efficiency is 95%.
- OR**
- a) Steam with jet velocity 960m/s enters the single stage turbine at an angle of 20° to the plane of wheel. The blade angle at the exit of moving blade is 30°. The blade speed is 250m/s at the rate of 60kg/min. Neglecting friction losses in the moving blade determine: 4
- blade efficiency,
  - power developed and,
  - stage efficiency if the nozzle efficiency is 95%.
- b) Explain with neat figure Impulse steam turbine. Discuss the terms pressure, velocity compounding along with figure. 4
- Q3 a) Explain with neat sketch Splash Lubrication System 3
- b) Draw self explanatory sketches of various types of Heat exchangers. 3
- c) State Bernoulli's Equation along with its assumptions. 2
- Q4 a) Water is flowing through two different pipes to which an inverted differential manometer having an oil of specific gravity 0.8 is connected. The pressure head in the pipe A is 2m of water, find the pressure in the pipe B of the manometer readings as shown in figure I. 4

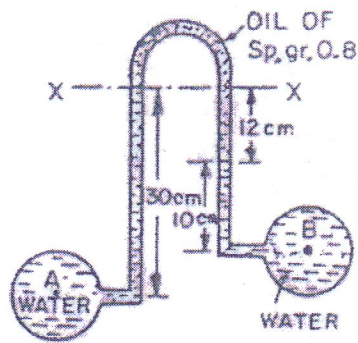


Figure 1

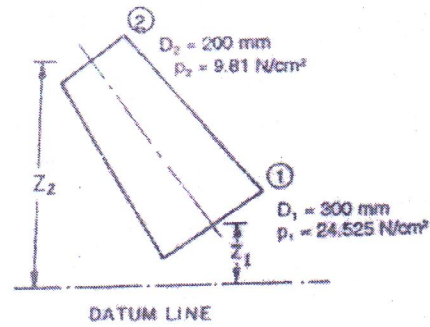


Figure 2

OR

- a) A horizontal venturimeter with inlet and throat diameter 30cm and 15cm respectively is used to measure the flow of water. The reading of differential manometer connected to the inlet and the throat is 20 cm of mercury. Determine the rate of flow Take  $C_d = 0.98$ . 4
- b) Water is flowing through a pipe having diameter 300mm and 200mm at the bottom and the upper end respectively as shown in Figure 2. The intensity of pressure at bottom end is  $24.525\text{N/cm}^2$  and the pressure at the upper end is  $9.81\text{N/cm}^2$ . Determine the difference in datum end if the rate of flow through the pipe is 40liters/sec. 4
- Q5 a) Explain with neat sketch the working of Kaplan hydraulic turbine. 3  
 b) Explain with neat sketch the working of Reciprocating pump. 2  
 c) Discuss in detail the classification of Hydraulic turbines. State the function and importance of draft tube in Reaction turbines. 3
- Q6 a) i) State Fourier's Law along with its assumptions. 4  
 ii) Explain the concept, "LMTD" along with assumptions.  
 b) The interior of a refrigerator having inside dimension of 0.4m X 0.4 m base area and 2m height is to be maintained at  $6^\circ\text{C}$ . The walls of the refrigerator are constructed of one Mild Steel sheet ( $k = 46\text{W/m}^\circ\text{C}$ ) of 3.5mm thickness on outer side and one Stainless Steel sheet ( $k = 52\text{W/m}^\circ\text{C}$ ) of 3mm thickness on inner side; with 40mm of glass wool insulation ( $k = 0.048\text{W/m}^\circ\text{C}$ ) between them. If the average heat transfer coefficient at the inner and outer surfaces are  $9.5\text{W/m}^2^\circ\text{C}$  &  $12.8\text{W/m}^2^\circ\text{C}$  respectively. Calculate, 6  
 i. the rate at which heat must be removed from the interior to maintain the specific temperature in the kitchen at  $25^\circ\text{C}$  and  
 ii. the temperature on the outer surface of the metal sheet.
- OR
- b) A steam pipe 170/160 mm in diameter is covered with two layers of insulation. 6  
 The thickness  $\delta_2$  of the first layer is 30 mm and that of the second layer  $\delta_3 = 50$  mm. the thermal conductivities  $K_1, K_2$  and  $K_3$  of the pipe and insulating layers are 50, 0.15 and 0.08  $\text{W/mK}$  respectively. The temperature of the inner surface of steam pipe is  $300^\circ\text{C}$  and that of the outer surface of the insulation layer is  $50^\circ\text{C}$ . Determine the quantity of heat lost per meter length of steam pipe and layer contact temperatures. If the steam is fully saturated, find the quality of the steam coming out of 1 m pipe assuming quantity of the steam flowing is 0.25 kg/min.



# COLLEGE OF ENGINEERING PUNE-5.

(Formerly Government College of Engineering, Pune-411005).

## END SEMESTER EXAMINATION- November 2010

### EE215- Electrical Technology

Programme: S.Y.B.Tech. Metallurgical Engineering

Date: 23/11/2010

Year: 2010-11 (First Semester)

Max. Marks: 50

Duration: 3 Hours. (10 am to 1 pm)

- Instructions:**
- 1) Solve two sub questions (a, b) from each question.
  - 2) Each sub question carries 5 marks.
  - 3) Draw neat figures and assume necessary data wherever required.

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Q.1.

- (a) What is a back emf in a d c motor explain with equation? Why the starting current of d c motor is higher than the normal full load current? How it can be controlled?

OR

- (a) State and explain the important performance tests on d. c. motors and generators.  
(b) The armature of a 4 pole, lap wound shunt generator has 120 slots with 4 conductors per slots. The flux per pole is 0.05 Wb. The armature resistance is  $0.05 \Omega$  and shunt field resistance  $50 \Omega$ . Find the speed of the machine when supplying 450 A at terminal voltage of 250 V.

Q.2.

- (a) The parameters of equivalent circuit of a 400V, 3-phase, 6-pole, 50 Hz, star connected induction motor are,  
 $R_o = 100 \Omega$ ,  $X_o = 20 \Omega$ ,  $r_1 = 0.3 \Omega$ ,  $x_1 = 0.4 \Omega$ ,  $r_2' = 0.2 \Omega$ ,  $x_2' = 0.4 \Omega$ .  
Full load slip is 0.04. Find (a) motor speed, (b) stator current at no load, (c) stator current at full load, (d) motor input at full load (e) rotor copper losses, (f) motor output and efficiency. Assume stator losses and mechanical losses to be 2 kW each.  
(b) Explain the difference between 3-phase and 1-phase induction motor with reference to starting process and starting torque.

OR

- (b) State the factors to be considered for selecting a motor for a particular application. Suggest a suitable motor with reason and characteristic for, (a) crane, (b) mine applications.

Q.3

- (a) A 400V, 10 kVA, 3-phase alternator with star connected stator winding has an effective armature resistance per phase of  $1 \Omega$ . The alternator generates an open circuit voltage per phase of 90 V with a field current of 1 A. During the short circuit current flowing in the armature is 15 A. Calculate (i) the synchronous impedance, (ii) synchronous reactance, (iii) if the alternator is supplying a load current of 15 A at 0.8

power factor lagging, to what value would the terminal voltage rise if the load is thrown-off, (iv) calculate the regulation at (a) 0.8 lagging, (b) unity p.f.

- (b) Explain how the constant voltage and frequency is assured at the terminals of the alternator under varying load condition?

**OR**

- (b) Explain two heating techniques used in domestic cooking applications.

**Q. 4**

- (a) State the principle of electroplating and its desirable properties.

**OR**

- (a) Compare high frequency and power frequency heating. Explain the coreless induction furnace operation, advantages and disadvantages.

- (b) A 30 kW, 3 phase, 400 V resistance oven is to employ nickel-chromium strip 0.254 mm thick for the three, star connected heating elements. If the wire temperature is to be 1100 °C and that of the charge is to be 700 °C, estimate a suitable width for the strip. Assume, emissivity ( $\epsilon$ )=0.9, radiating efficiency ( $K$ )=0.5, specific resistivity ( $\rho$ )= $1.016 \times 10^{-6} \Omega\text{-m}$ . What would be the temperature of the wire, when the charge is cold (20°C)?

**Q.5**

- (a) Give the detailed classification chart of electrical welding methods. Explain modern electric welding techniques.

**OR**

- (a) Explain the construction and working of arc welding transformer and show how it is used in welding process.
- (b) Explain the dielectric heating process with diagrams. List out its important applications.

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