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Enrolment No:



UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Sem Examination, December 2020

Course: Material Science

Program: B. Tech Mechatronics Engineering (special QP-lateral entry)

Time 03 hrs.

Course Code: MEMA 2001 Max. Marks: 100

Instructions:

SECTION A: Each ques carries 5 marks

S. No.		Marks	CO
Q 1	Write true or false: (i) Tempered martensite has better ductility than martensite. (ii) X-ray diffraction is used to identify the crystal structure of a material. (iii) Brass is an alloy of Nickel. (iv) Glasses are polycrystalline in nature. (v) Aluminium has hcp crystal structure.	5	CO1
Q 2	Classify following materials into the typing of bonding that exists (ionic/covalent/metallic/ Secondary bonding): a) NaCl, b) Teflon, c) Bronze, d) Liquid Helium, e) Solder a), b), c), d), e)	5	CO1
Q 3	 (a) Amount of carbon in low carbon, medium carbon and high carbon steels respectively is, and (b) Carbon steels have amount of alloying elements (low/high). (c) Stainless steels have as an important alloying element for corrosion protection. 	5	CO1
Q 4	Creep failure is	5	CO1
Q 5	Classify following materials into their class of materials (metal/alloy, polymer, ceramic, composite): a) Superalloy, b) Teflon, c) Bronze, d) Alumina, e) Carbon fibre reinforced polymer a), b), c), d), e)	5	CO2
Q 6	 (i) For single component system when degree of freedom is '1' then number of phases are: (a) 0 (b) 1 (c) 2 (d) 3 (ii) At what temperature Fe turns paramagnetic while heating (a) 727 °C (b) 623 °C (c) 1146 °C (d) 1500 °C (iii) Phenomenon involved in phase transformation: (a) Nucleation (b) Growth (c) both a and b (d) none of these 	5	CO2

	(iv) is not a non-ferrous metal.		
	(a) Aluminium (b) Zinc (c) Lead (d) Iron		
	(v) is alloyed with silver to make sterling silver.		
	(a) Iron (b) Copper (c) Tin (d) Magnesium		
	SECTION B: 10 marks each		
Q 7	Sketch neat and labelled crystal structure of Martensite and describe the process of structural evolution during rapid cooling.	10	CO5
Q 8	Sketch completely labelled stress vs strain curve for ductile and brittle materials and name the testing technique used to obtain these curves.		CO2
Q 9	Define fatigue failure. Neatly sketch the various fatigue loading cycles.		CO2
Q 10	Describe ceramic materials in brief. Write properties and applications of abrasives with examples.	10	CO3
Q 11	Sketch and explain the microstructure evolution of eutectoid steel at 727 °C.	10	CO5
	SECTION-C: 20 marks (Attempt either 12A or 12B)		
Q 12	Α.	6	
	(i) Sketch neat and completely labelled TTT curve.	8	
	(ii)Discuss the effect of cooling rate on grain size using example of various microstructures formed during heat treatments.(iii)Using Hall-Petch equation, discuss the effect of grain size on strength.	6	
	OR		CO4
	B.		
	(i) Describe annealing, normalizing and quenching processes.	4.5	
	(ii) Discuss Cyaniding and nitriding processes.	12	
	(iii) Under what necessary cooling conditions, martensite forms.	6 2	