Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

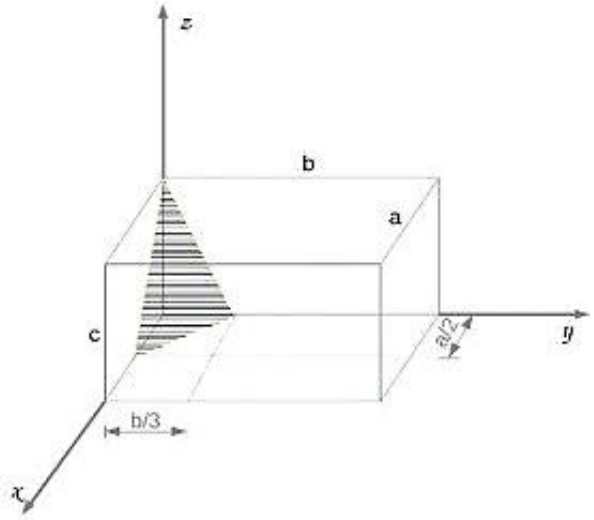
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2019

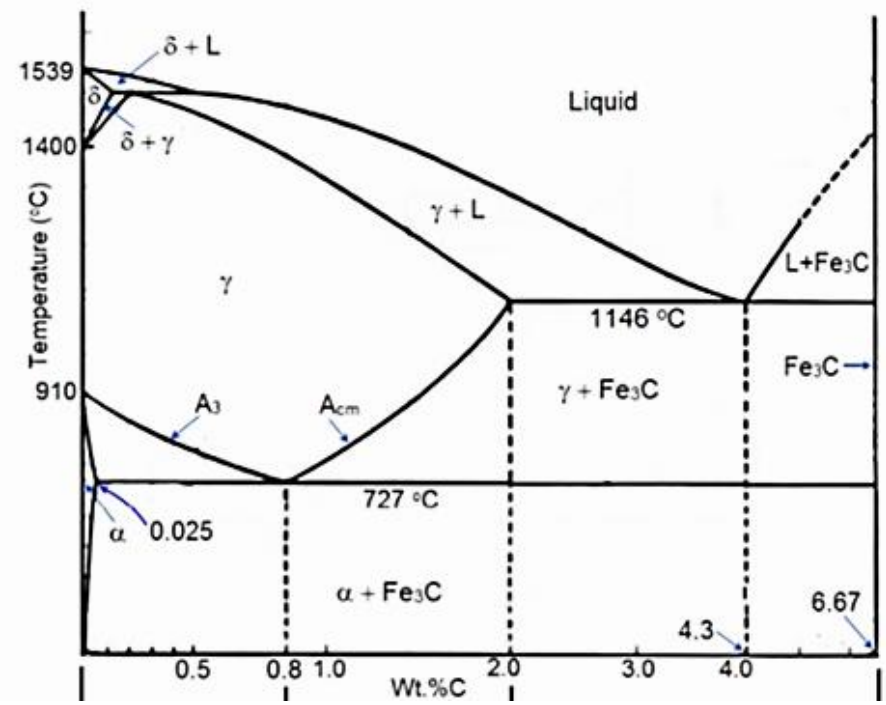
Course: Material Science **Semester: III**
Program: B. Tech Chemical + RP/ Mechatronics **Time 03 hrs.**
Course Code: MEMA 2001 **Max. Marks: 100**

Instructions:

SECTION A: 20 marks

S. No.		Marks	CO
Q 1	Write true or false: (i) Tempered martensite has better ductility than martensite. (ii) When steel with exactly 0.8% carbon by weight is cooled, the FCC structure of the mixture tries to revert back to its BCC structure. (iii) Monel is alloy of Nickel. (iv) Talc is not a ceramic. (v) Aluminium has fcc crystal structure.	**5**	**CO1**
Q 2	Select the correct answer. (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 ℃ (b) 623 ℃ (c) 1146 ℃ (d) 1500 ℃ (iii) Phenomenon involved in phase transformation: (a) Nucleation (b) Growth (c) both a and b (d) none of these (iv) _____ is not a non-ferrous metal. (a) Aluminium (b) Zinc (c) Lead (d) Iron (v) Which of the following can be the percentage of carbon in steel? (a) 2 % (b) 3 % (c) 4% (d) 5 % (vi)_____ is alloyed with silver to make sterling silver. (a) Iron (b) Copper (c) Tin (d) Magnesium (vii) _____ is an advanced ceramic. (a) Diamond (b) Glass (c) Silica (d) None (viii)Density of crystal structure is affected in _____ defect. (a) Frenkel (b) Schotky (c) Both (d) None (ix) Packing efficiency of a crystal structure is the ratio of: a) Volume occupied by atoms to the total volume of the unit cell b) Volume occupied by atoms to that by voids	**10**	**CO1**

	c) Total volume of the unit cell to the volume occupied by atoms d) Volume occupied by voids to that by atoms (x) Miller indices of hatched plane are (a) (231) (b) (321) (c) (123) (d) (121)  		
Q 3	Classify composite materials based on various parameters. List the functions of matrix material in a composite.	**5**	**CO1**
	SECTION B: 40 marks		
Q 4	With the help of neat sketch, describe the process of microstructure evolution of Martensite during rapid cooling.	**10**	**CO5**
Q 5	Sketch completely labelled stress vs strain curve for ductile and brittle materials and name the testing technique used to obtain these curves.	**10**	**CO2**
Q 6	Define fatigue failure. Neatly sketch the various fatigue loading cycles.	**10**	**CO2**
Q 7	Describe ceramic materials in brief. Write properties and applications of abrasives with examples. OR Describe gray cast iron and nodular cast iron. Write their properties and applications.	**10**	**CO1**
	SECTION-C: 40 marks (Attempt either 8A or 8B, 9th is mandatory)		
Q 8	**A.** (i) Sketch neat and completely labelled TTT curve. (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. **OR** **B.** (i) Describe annealing, normalizing and quenching processes. (ii) Discuss Cyaniding and nitriding processes. (iii) Under what necessary cooling conditions, martensite forms.	**6** **8** **6** **12** **6** **2**	**CO4**

Q 9	A. Analyze the figure and answer the following questions: (i) Write the solubility of carbon in ferrite at 727 °C. (ii) At what temperature solubility in austenite phase is maximum. (iii) Write the name of eutectoid product. (iv) Write eutectoid, eutectic and peritectic temperatures. (v) Write all the invariant reactions in this diagram.  B. Sketch and explain the microstructure evolution of eutectoid steel at 727 °C.	**1** **1** **1** **3** **6** **8**	**CO3** **CO5**