

Name:			
Enrolment No:			
<b>UNIVERSITY OF PETROLEUM AND ENERGY STUDIES</b> <b>End-Semester Examination, Dec. 2020 (ONLINE MODE)</b>			
<b>Course: Materials Science</b> <b>Program: CE+RP</b> <b>Course Code: MEMA2001</b> <b>Instructions:</b>		<b>Semester: III</b> <b>Time : 3 hrs</b> <b>Max. Marks: 100</b>	
<b>SECTION A</b>			
S. No.		Marks	CO
1	Critical size ratio for the cations and anions to form a tetrahedral structure in ceramic materials is _____. Cesium chloride structure is a BCC structure. The statement is: a) True b) False	5	CO4
2	The coordination number in zinc blende structure is _____. The cations in the same zinc blende structure have a: a) BCC structure b) FCC structure c) Simple cubic structure Pick the correct answer.	5	CO4
3	Austenite structure is a type of equilibrium structure while martensite is a type of non-equilibrium structure. The statement is: a) True b) False Cementite is a type of _____ material.	5	CO5
4	Presence of vacancies in the crystal increases the _____. The same property of the pure crystalline material at absolute zero is _____.	5	CO1
5	Eutectoid reaction is: a) Diffusion dependent but no change in number of phases b) Diffusion dependent with change in number of phases c) Diffusion-less Pick out the correct alternative The region between the solvus lines in a eutectic phase diagram is _____ region.	5	CO2
6	Hooke's law is no longer valid beyond the _____ point. The value of the stress at the same point is called the _____.	5	CO3
<b>SECTION B</b>			
S. No.		Marks	CO
7	Show that the cation to anion ratio for a coordination number of 6, lies in the range 0.414 - 0.732	10	CO4
8	Describe the following heat treatment processes in your own words. a) Process annealing, b) Stress relief	10	CO5

9	The density and associated % crystallinity for two poly-tetrafluoroethylene materials are as follows:	10	CO4	
	$\rho$ (gm/cc)			Crystallinity (%)
	2.144			51.3
	2.215	74.2		
Calculate the densities of the totally crystalline and totally amorphous materials. Also compute the crystallinity when the density of the material is 2.26 gm/cc.				

10	Elucidate in detail the differences between the production of austenite and martensite by heat treatment. What are the primary differences between the two end products?	10	CO5
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11	A tensile test is performed on a metal specimen and it is observed that a true stress of 100 MPa produces a true strain of 0.005. Assuming that the material remains in the elastic regime, determine the true strain when the true stress of the material is 200 MPa. Also assume that no volume change occurs in the material.	10	CO3
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**SECTION C**

12	<p>A 1.5 kg specimen of 90 wt % Pb – 10 wt % Sn is pre-heated to 250°C where it is in the <math>\alpha</math>- solid solution state. The solid is melted in such a way that 50 % of the material is liquid with the remaining being in the <math>\alpha</math>- phase. This may be accomplished either by increasing the temperature of the solid solution or by adding more Sn to it, thus changing the composition while keeping the temperature constant.</p> <p>a) To what temperature must the specimen be heated?</p> <p>b) How much Sn (in kgs) must be added to the 1.5 kg specimen to achieve the above state?</p>	20	CO2