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MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL (A constituent unit of MAHE, Manipal)

DEPARTMENT OF MECHATRONICS VII SEMESTER B.TECH. MECHATRONICS

END SEMESTER EXAMINATIONS, DEC. 2021

SUBJECT: ENGINEERING MATERIALS [MTE 4071]

Date: 20/12/2021

MAX. MARKS: 50

		Instructions to Candidates:					
		Answer ALL the questions.					
		 Data not provided any, may be assumed suitably. 					
Q. No	PAR	$\Gamma - A (30 \times 1 = 30 \text{ Marks})$ 50 Mins.	M	CO	РО	LO	BL
1.	Force	s applied to a segment of material lead, to an appearance of electrical charg	e 1	5	4	4	2
	on the	surfaces of the segment is called as					
	a.	Piezoelectric Effect					
	b.	Magnetostrictive Effect					
	c.	Conduction					
	d.	Magnetization					
2	C		1	_	4	4	2
2.	Gener	ation of stress when an electric field is applied is called as	1	Э	4	4	2
	я	Direct Piezoelectric Effect					
	a. h	Converse Piezoelectric Effect					
	c.	Semi conductivity					
	d	Two-way shape memory effect					
3.	Whic	among the following is not a natural piezoelectric material?	1	5	4	4	2
	a.	Berlinite					
	b.	Quartz					
	c.	Tourmaline					
	d	Barium Titanate					
4			1 1	_			_
4.	Mater	alls developing large mechanical deformations when subjected to an externa		5	4	4	2
	magn	enc heid are called as					
	а	Piezoelectric Materials					
	b.	Semiconducting Materials					
	c.	Magnetostrictive Materials					
	d.	Optical Materials					
		•					
				1	1		

5.	Change in Magnetization due to applied stress is called as	1	5	4	4	2
	a Villari Fffaat					
	a. Villari Effect					
	c. Nagoka-Honda Effect					
	d Wiedemann effect					
6.	Torque induced by helical magnetic field is called as	1	5	4	4	2
	a Villari Effect					
	a. Villall Effect					
	c. Nagoka-Honda Effect					
	d Wiedemann effect					
7.	Change in the magnetic state due to change in the volume is called as	1	5	4	4	2
	a. Villari Effect					
	b. Joule Effect					
	c. Nagoka-Honda Effect					
	d. Wiedemann effect					
8.	Austenite phase in a shape memory alloy (SMA) is characterized by	1	5	4	4	2
	a. Simple FCC structure					
	b. High Temperature state					
	c. Hard, firm					
	d. All of the above					
9.	Example for magnetic material used in data storage devices	1	5	4	4	2
					_	
	a. 45 Permalloy					
	b. CrO_2					
	c. Cunife					
	d. Alnico					
10.	The effective number of lattice points in the unit cell of simple cubic, body centered	1	1	4	4	2
	cubic, face centered cubic space lattices are					
	100					
	a. 1,2,2					
	b. 1,2,4					
	c. 2,3,4					
	d. 2,4,4					
11.	If a particular Fe-C alloy contains less than 0.83% carbon, it is called as	1	1	4	4	2
	a. High Speed Steel					
	b. Hypoeutectoid Steel					
	c. Hypereutectoid Steel					
	d. Cast Iron					

12.	Which one of the following factors is more relevant to represent complete solubility	1	4	4	4	2
	of two metals in each other?					
	a. Chemical Affinity					
	b. Valency Factor					
	c. Crystal Structure Factor					
	d. Relative Size Factor					
13.	The correct statement for Burger's vector in screw dislocation is	1	3	4	4	2
	a. Perpendicular to dislocation line					
	b. Inclined to dislocation line					
	c. Parallel to dislocation line					
	d. Opposite to dislocation line					
14.	Pearlite phase in an iron-carbide diagram is	1	4	4	4	2
		-	•	•		-
	a Eutectic Phase					
	b Hypoeutectic Mixture					
	c Futectoidal Mixture					
	d Hypereutectic Mixture					
15	Austempering is employed to obtain	1	4	4	4	2
13.	Austempering is employed to obtain	1	-	-	-	4
	a 100% Marternsite					
	h 100% Bainite					
	c 50% Martenoite and 50% Bainite					
	d 100% Pearlite					
16	In a conventional annealing process, austenite transforms into	1	4	4	4	2
10.	in a conventional ameaning process, adsternee transforms into	•	-	-	-	-
	a Coarse Pearlite					
	h Fine Pearlite					
	c. Upper Bainite					
	d. Madium Baarlita					
	u. Medium Feature					
17	If a steal allow having either peoplitic or beinitic microstructures is bested to and	1	1	1	1	2
1/.	If a steel alloy having entiel pearine of balance incrossituctures is heated to, and	I	-	-	-	2
	resulting microstructure formed is					
	resulting microstructure formed is					
	a Martansita					
	a. Wattensite					
	o. rempered Martenshe					
	c. spherodite					
	a. Austenite					

18.	Alternative layers of α – ferrite and Fe ₃ C that are relatively thin is observed in	1	4	4	4	2
	a Poinita					
	a. Danne b. Fine Pearlite					
	c Coarse Pearlite					
	d Martensite					
19.	A cube elongated in one direction such that $a=b\neq c$ is called as	1	1	4	4	2
	a. Tetragonal Structure					
	b. Orthorhombic Structure					
	c. Monoclinic					
	d. Triclinic					
20.	The magnitude of the electric field required to cause dielectric breakdown is called	1	5	4	4	2
	as					
	a. Breakdown Strength					
	b. Dielectric Loss					
	c. Polarization					
	d. Space Charge					
21.	If the magnetic susceptibility of a material is small, constant and negative, the	1	5	4	4	2
	magnetism shown by the material is	-	-	-	-	_
	a. Paramagnetism					
	b. Ferromagnetism					
	c. Diamagnetism					
	d. Ferrimagnetism					
22.	Highest specific modulus and highest specific strength is observed in	1	5	4	4	2
	a. Aramid Fibre-reinforced polymer composites					
	b. Carbon Fibre-reinforced polymer composites					
	c. Glass Fibre-reinforced polymer composites					
	d. Metal Matrix Composites					
23.	In an AA6061 metal matrix, boron as reinforcement material, the fiber content is	1	5	4	4	2
	a. 48 vol.%					
	b. 45 vol.%					
	c. 52 vol.%					
	d. 38 vol.%					
24	A resolution range of 10^{-10} to 10^{-4} is observed in	1	2	1	1	2
24 .		I	5	4	-	4
	a. Scanning Probe Microscope					
	b. Scanning Electron Microscope					
	c. Transmission Electron Microscope					

	d. Optical Microscope					
25.	The percentage of carbon at eutectic point in Fe-C phase diagram is	1	4	4	4	2
	a 43					
	a b. 21					
	c. 0.76					
	d. 0.2					
26.	Mechanical properties of fiber-reinforced composites depend on	1	4	4	4	2
	a Dramantica of Constituents					
	a. Properties of Constituents b. Interface Strength					
	 D. Interface Strength a. Fibra length orientation and volume fraction 					
	d All of the above					
	u. An of the above					
27.	If a Fe-C alloy is cooled at a rate greater rate than that of CCR, the product formed	1	4	4	4	2
	is					
	a. Bainite					
	b. Martensite					
	c. Pearlite					
	d. Austenite					
28.	The heat treatment process to enhance the ductility and toughness of martensite,	1	4	4	4	2
	relieving internal stresses is done by					
	a Annaeling					
	a. Anneaning b. Normalizing					
	c. Tempering					
	d Austempering					
	u. Austempering					
29.	The attribute of a material which resists the flow of electricity is known as	1	5	4	4	2
	a. Conductivity					
	b. Thermoelectricity					
	c. Dielectric strength					
	a. Resistivity					
30.	Pyrometer works based on	1	5	4	4	2
	a. Laser technology					
	b. Photo-conduction					
	c. Thermal emission					
	d. Tyndall effect					

PAR	T – B (20 MARKS)				75 N	lins.
1A.	For the 40 wt.% $Sn - 60$ wt.% Pb alloy, calculate the relative amount of each phase	4	4	2	2	3,4
	present in terms of:					
	(a) mass fraction, and					
	(b) volume fraction.					
	At 150°C, take the densities of Pb and Sn to be 11.23 and 7.24 g/cm ³ , respectively.					
	Refer figure 1A.					
	Composition (M*)SR 0 0 0 0 0 0 0 0 0 0 0 0 0					
1 B .	The metal niobium has a BCC crystal structure. If the angle of diffraction for the	3	2	2	1	3
	(211) set of planes occurs at 75.99° (first-order reflection) when monochromatic x-					
	radiation having a wavelength of 0.1659 nm is used, Compute:					
	(a) the interplanar spacing for this set of planes, and					
	(b) the atomic radius for the niobium atom.					
1C.	Mr. X fabricated an XX sample for his research purposes. He wants to do	3	3	4	4	4
	characteristic study the topography of the specimen on an atomic scale and with					
	high magnification in the range of $10^9 \times$. As XX is reactive in normal conditions, the					
	study has to be done in vacuum environment. Assess Mr. X's requirements and					
	suggest a suitable examination technique. Discuss its working principle.					
2A.	The magnetization within a bar of some metal alloy is 1.2×10^6 A/m an H field of	4	5	2	1	3,4
	200 A/m. Calculate the following:					
	(a) magnetic susceptibility,					
	(b) permeability, and					
	(c) magnetic flux density within this material.					
	For the above-mentioned alloy, infer what type of magnetism is exhibited by the					
	alloy and why?					

	Permeability of vacuum is 1.257×10 ⁻⁶ H/m.					
2B.	Explain how piezoelectric effect affects the sensing and actuating property in a piezo pressure sensor.	3	5	4	4	2
2C.	Discuss how magnetostrictive sensor is used in hydraulics/pneumatic cylinders to determine the end stroke and home of the piston head of the cylinder.	3	5	4	4	2