

Total No. of Questions – [3]

Total No. of Printed Pages: 4

G.R./PRN No.	
-----------------	--

PAPER CODE	U112-209B (Reg)
------------	-----------------

**DECEMBER 2022 (INSEM+ ENDSEM) EXAM**

**F.Y. B. TECH. (SEMESTER - I)**

**COURSE NAME: MATERIAL SCIENCE**

**COURSE CODE: ES10209B**

**(PATTERN 2020)**

Time: [2Hr]

[Max. Marks: 60]

**(\*) Instructions to candidates:**

- 1) **Figures to the right indicate full marks.**
- 2) **Use of scientific calculator is allowed**
- 3) **Use suitable data where ever required**

Question No.	Question Description	Marks	CO mapped	Blooms Taxonomy Level																
Q.1)	<p><b>Solve the following:</b></p> <p>i) _____ is added in the Portland cement to retard initial setting and _____ accelerates initial setting respectively during setting and hardening.</p> <p>a) Tricalcium Silicate and Dicalcium Silicate b) Dicalcium Silicate and Tricalcium Silicate c) Tricalcium Aluminate and Gypsum d) Gypsum and Tricalcium Aluminate</p> <p><b>ii) Match the following:</b></p> <table><tr><td>P</td><td>Heat resistant steel</td><td>(i)</td><td>Nichrome</td></tr><tr><td>Q</td><td>Spring steel</td><td>(ii)</td><td>Chrome vanadium steel</td></tr><tr><td>R</td><td>Magnetic steel</td><td>(iii)</td><td>Alnico</td></tr><tr><td>S</td><td>Corrosion resistant steel</td><td>(iv)</td><td>Stainless steel</td></tr></table> <p>a) P-(i), Q-(ii), R-(iii), S-(iv) b) P-(ii), Q-(iii), R-(iv), S-(i) c) P-(iii), Q-(iv), R-(i), S-(ii) d) P-(iv), Q-(i), R- (ii), S-(iii)</p> <p><b>iii) German silver is used in _____ and Gun metal is used in _____ respectively.</b></p> <p>a) Hardware and musical instrument b) Hydraulic fittings and Table ware c) Heat resistant coils and condenser tubes d) Table ware and Foundry work</p>	P	Heat resistant steel	(i)	Nichrome	Q	Spring steel	(ii)	Chrome vanadium steel	R	Magnetic steel	(iii)	Alnico	S	Corrosion resistant steel	(iv)	Stainless steel	<p>[2]</p> <p>[2]</p> <p>[2]</p>	<p>1</p> <p>1</p> <p>1</p>	<p>Understand</p> <p>Remember</p> <p>Remember</p>
P	Heat resistant steel	(i)	Nichrome																	
Q	Spring steel	(ii)	Chrome vanadium steel																	
R	Magnetic steel	(iii)	Alnico																	
S	Corrosion resistant steel	(iv)	Stainless steel																	

<p>iv) Match the following:</p> <table border="1"> <tr> <td>P</td><td>Piezoelectric material</td><td>(i)</td><td>Conversion of Austenite to Martensite</td></tr> <tr> <td>Q</td><td>Magnetorheological fluid</td><td>(ii)</td><td>Conversion of mechanical stress to electrical potential</td></tr> <tr> <td>R</td><td>Electrorheological fluid</td><td>(iii)</td><td>Changes rheological properties under magnetic field</td></tr> <tr> <td>S</td><td>Shape memory alloy</td><td>(iv)</td><td>Changes rheological properties under electric field</td></tr> </table> <p>a) P-(ii), Q-(iii), R-(iv), S-(i)  b) P-(i), Q-(ii), R-(iii), S-(iv)  c) P-(iii), Q-(iv), R-(i), S-(ii)  d) P-(iv), Q-(i), R-(ii), S-(iii)</p> <p>v) Which of the following is not an application of piezoelectric material  a) Accelerometer  b) Gas lighter  c) Vibration sensors  d) Transformer</p> <p>vi) Select correct statements of the following:  (1) A magnetorheological fluid on the application of magnetic field, changes its viscosity till it becomes viscoelastic solid.  (2) MR fluids consist of dispersions of micron sized particles of magnetizable materials.  (3) In MR fluid, the magnetic particles, which are typically micrometer scale spheres or ellipsoids, are suspended within the carrier oil.  (4) The MR fluid acts irreversible as when the magnetic field is removed, the fluid does not return to its original condition.  (5) MR fluids cannot be used in dirty or humid atmosphere.  a) (1), (3), (5)  b) (2), (3), (4)  c) (1), (2), (3)  d) (1), (4), (5)</p> <p>vii) In the positive ER fluid _____ and in negative ER fluid _____ respectively.  a) Viscosity decreases with electric field, viscosity increases with electric field.  b) Electric field increases, electric field decreases.  c) Viscosity increases with electric field, viscosity decreases with electric field.  d) Viscosity increases with magnetic field, viscosity decreases with magnetic field.</p> <p>viii) _____ imparts strength and _____ imparts soundness to the cement respectively.  a) Alumina and Sulphur trioxide  b) Calcium sulphate and Alkali  c) Silica and Sulphur trioxide  d) Calcium sulphate and Iron oxide</p> <p>ix) Structural weaknesses arise in final product after polymer recycling because of _____ (select appropriate sentences)  (1) Different types of recycling techniques are used  (2) Same types of plastics are melted together  (3) Different types of plastics are melted together  (4) Same type of recycling technique is used  (5) Number of times polymer is recycled  a) (1) and (2)  b) (3) and (4)  c) (3) and (5)</p>	P	Piezoelectric material	(i)	Conversion of Austenite to Martensite	Q	Magnetorheological fluid	(ii)	Conversion of mechanical stress to electrical potential	R	Electrorheological fluid	(iii)	Changes rheological properties under magnetic field	S	Shape memory alloy	(iv)	Changes rheological properties under electric field	<p>[2]</p> <p>[2]</p> <p>[2]</p> <p>[2]</p> <p>[2]</p> <p>[2]</p> <p>[2]</p> <p>[2]</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>2</p>	<p>Understand</p> <p>Application</p> <p>Understand</p> <p>Understand</p> <p>Remember</p> <p>Understand</p>
P	Piezoelectric material	(i)	Conversion of Austenite to Martensite																
Q	Magnetorheological fluid	(ii)	Conversion of mechanical stress to electrical potential																
R	Electrorheological fluid	(iii)	Changes rheological properties under magnetic field																
S	Shape memory alloy	(iv)	Changes rheological properties under electric field																

	<p>d) (1) and (5)</p> <p>x) Structural requirement for intrinsic conducting polymers are _____ and _____.</p> <p>a) Polymers are highly crystalline and has high planarity b) Polymers are less crystalline and has high planarity c) Polymers are highly crystalline and has low planarity d) Polymers are less crystalline and has low planarity</p> <p>xi) Liquid crystal display work on the principle of _____ and it uses _____ liquid crystal.</p> <p>a) refracting light for display and Nematic Liquid crystal b) emitting light for display and Smectic Liquid crystal c) generating light for display and Cholesteric Liquid crystal d) blocking light for display and Nematic Liquid crystal</p> <p>xii) _____ is used for thermal insulation of walls and _____ is used for Polymer optical fibers</p> <p>a) Expanded Polystyrene and Polymethyl Methacrylate b) Polyethylene and Polystyrene c) PPV and Nylon 6,6 d) Polycarbonate and Nylon 6,6.</p> <p>xiii) In PLED, _____ is used as anode and _____ is used as cathode</p> <p>a) Calcium and Aluminium b) Aluminium and Indium Tin Oxide c) PPV and Aluminium d) Indium Tin Oxide and Aluminium</p> <p>xiv) Which of the following is not applicable for Vitrimers? (1) Vitrimers are permanent chemical networks with dynamic Vander wall bonds. (2) Vitrimers are a class of plastics, which are derived from thermosetting polymers (3) Epoxy based vitrimers are used as adhesives (4) Vitrimers are strong glass formers (5) Vitrimers do not have the ability to weld objects together.</p> <p>a) (1) and (2) b) (3) and (4) c) (1) and (5) d) (2) and (5)</p> <p>xv) Which of the following polymers will have high crystallinity? a) LDPE and Atactic polystyrene b) Natural rubber and Polyvinyl alcohol c) Nylon 6 and Gutta Purcha d) LDPE and Polyvinyl alcohol</p>	[2]	2	Remember									
		[2]	2	Understand									
		[2]	2	Remember									
		[2]	2	Remember									
		[2]	2	Understand									
		[2]	2	Application									
Q2)	<p>Solve any three out of four</p> <p>a) Give principle of cathodic protection. Explain sacrificial anodic protection method with method, figure and any 2 applications.</p> <p>b) Identify in the following pairs, which will undergo faster corrosion in Case 1 and Case 2? why?</p> <table><tr><th>Sr. No.</th><th>Case 1</th><th>Case2</th></tr><tr><td>1</td><td>Steel pipe in river water</td><td>Steel pipe in sea water</td></tr><tr><td>2</td><td>Steel tank with water at room temperature</td><td>Steel tank with water at high temperature</td></tr></table>	Sr. No.	Case 1	Case2	1	Steel pipe in river water	Steel pipe in sea water	2	Steel tank with water at room temperature	Steel tank with water at high temperature	[5]	3	Understand
Sr. No.	Case 1	Case2											
1	Steel pipe in river water	Steel pipe in sea water											
2	Steel tank with water at room temperature	Steel tank with water at high temperature											
		[5]	3	Application									

	<p>c) Identify types of oxide films formed on the surface of following metals (i) Ag (ii) Ca (iii) Zn (iv) Mo (v) Cu. Explain with oxidation reactions.</p> <p>d) Identify the most appropriate and economical corrosion protection method for the following situations:</p> <ol style="list-style-type: none"> <li>1) Water tanks, buried pipe lines, Transmission line towers.</li> <li>2) Steel table tops, mild steel doors clad with brass. window panels, mild steel pipe clad internally and externally with brass</li> <li>3) Chemical reactors, Pipe lines for carrying corrosive liquids or solutions.</li> <li>4) Office furniture, domestic appliances, industrial shelving, hand and power tools, heating and air conditioning units, computers, cars.</li> <li>5) Nuts, bolts, screws, spanners, screw drivers.</li> </ol>	[5]	3	Application
		[5]	3	Application
Q.3)	<p><b>Solve any three out of four</b></p> <p>a) Calculate possible number of fundamental vibrations in <math>C_6H_{12}</math>, <math>H_2O</math>, <math>CO_2</math>, <math>C_6H_6</math> &amp; <math>NH_3</math></p> <p>b) 1) What are the possible electronic transitions in the following molecules when they are exposed to UV-Visible radiations?</p> <ol style="list-style-type: none"> <li>i) <math>CH_2=CH-CH_2-CH=CH_2</math></li> <li>ii) <math>CH_3-CH_2-CH_2-CH_2-CH_3</math></li> </ol> <p>2) Explain any 3 applications of Scanning Electron Microscope (SEM).</p> <p>c) 1) How intermolecular and intramolecular hydrogen bonding is identified by IR spectroscopy?</p> <p>2) Identify the type of shift in <math>\lambda_{max}</math> value observed in UV-Visible spectroscopy when</p> <ol style="list-style-type: none"> <li>i) Aniline is treated with acid</li> <li>ii) p-Nitrophenol is treated with base</li> <li>iii) Naphthalene is converted to 2-Methyl Naphthalene</li> </ol> <p>d) Calculate Miller indices of the following intercepts of the plane made on crystallographic axis in cubic crystal system</p> <ol style="list-style-type: none"> <li>i) <math>1, \infty, \infty</math></li> <li>ii) <math>\infty, 1, \infty</math></li> <li>iii) <math>1, 1, 1</math></li> <li>iv) <math>\infty, \frac{1}{2}, \infty</math></li> <li>v) <math>1, 1, \infty</math></li> </ol>	[5]	4	Application
		[5]	4	Application
		[5]	4	Understand
		[5]	4	Understand
		[5]	4	Application
		[5]	4	Application