

**2714****Code : 20ME11T**Register  
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**I Semester Diploma Examination, March/April-2022****MATERIAL FOR ENGINEERING****Time : 3 Hours ]****[ Max. Marks : 100**

- Instructions :** (1) Answer **one** full question from each section.  
(2) **One** full question carries **20** marks.

**SECTION – I**

1. (a) List Engineering Materials on basis of natural and man made existence. **5**  
(b) Name the crystal structures. Which structure is generally found in Zirconium & Beryllium ? **5**  
(c) Explain Malleability and Ductility with suitable examples. **5**  
(d) Explain briefly etching process of specimen preparation. **5**
  
2. (a) Explain any five mechanical properties of metal. **5**  
(b) Define Crystal Lattice and unit cell. **5**  
(c) Explain briefly scanning electron microscope. **5**  
(d) Compare crystalline material with non-crystalline material. **5**

**SECTION – II**

3. (a) Explain composition of Nodular CI characteristics and list uses of it. **10**  
(b) Which metal is used for manufacturing of helical spring and why ? **5**  
(c) Which steel is used in manufacturing of agricultural equipments ? Justify. **5**
  
4. (a) What are tool steels. Classify tool steels. **10**  
(b) Why drill bits are made up of high carbon steel ? Justify. **5**  
(c) Answer the following in Yes or No :  
  - (i) Copper is an alloy.
  - (ii) Steel wire is more elastic than rubber.
  - (iii) Glass is brittle.
  - (iv) Aluminum is heavier than iron.
  - (v) Gun metal is a ferrous metal.



**SECTION – III**

5. (a) Transmission Gears, Railway track are made of which metal ? Justify the selection. 10  
 (b) Develop short notes on Austentic Stainless Steel. 5  
 (c) Analyse and infer the following designation of Steel/CI :  
 (i) FG 200 5  
 (ii) 30C 8
6. (a) Which tool steel is used for piercing dies and coining dies ? Justify the selection. 10  
 (b) Distinguish between Brass and Bronze. 5  
 (c) Write the Nickel alloy used in the manufacturing of  
 (i) Costume Jewellery  
 (ii) Furnace geysers  
 (iii) Pump fitting, Steam turbine blades  
 (iv) Aircraft engine  
 (v) Turbine engine 5

**SECTION – IV**

7. (a) List different Bearing materials Explain Cadmium based bearing material. 10  
 (b) Compare Thermo-plastics and Thermoset plastics. 5  
 (c) What type of smart materials used in Automotive industries & justify the application smart material ? 5
8. (a) Explain Polymers & its characteristics and applications. 10  
 (b) List different properties of ceramic materials and explain any one. 5  
 (c) Wings of Aircraft is made of which composite material and why ? 5

**SECTION – V**

9. (a) Cutting Edges of drill & saws are slowly accurately reheated & Quenched. Suggest suitable heat treatment process and list different types of Heat treatment process. 10  
 (b) Write 5 differences between dry chemical corrosion and wet chemical corrosion. 5  
 (c) What are the factors influencing corrosion ? 5
10. (a) A product is manufactured by using GI-Iron sheet for good appearance and to avoid corrosion. Which process is adopted ? Explain 10  
 (b) What are electrolytes ? Name different types. 5  
 (c) Explain the construction and working of Electro chemical cell. 5
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**I Semester Diploma Examinations March /April 2022**  
**MATERIALS FOR ENGINEERING-20ME11T**  
**SCHEME OF VALUATION**

SECTION I

1(a)	List Engineering Materials on basis of natural and man made existence	<i>1 marks for each materials (list five materials)(1*5=5)</i>	1*5=5M
1(b)	Name the crystal structures which structure is generally found in Zirconium & Beryllium?	<i>Explanation 3 marks and 2 marks for sketch.)</i>	3+2=5M
1(c)	Explain Malleability and Ductility with suitable examples	<i>Malleability definition with examples 2.5marks and Ductility definition with examples 2.5marks</i>	2.5+2.5=5M
1(d)	Explain briefly etching process of specimen preparation	<i>Explanation</i>	5M
2(a)	Explain any five mechanical properties of metal	<i>1 marks for each properties (Any five properties)</i>	1*5=5M
2(b)	Define Crystal lattice and unit cell	<i>2 marks for crystal lattice 2 marks for unit cell and 1 marks for sketch</i>	2+2+1=5M
2(c)	Explain briefly scanning electron microscope	<i>Explanation 3 mark and 2 marks for the sketch.</i>	3+2=5M
2(d)	Compare crystalline material with non crystalline material	<i>2 marks for crystalline and 2 marks for non crystalline and 1 marks for examples</i>	2+2+1=5M

SECTION II

3(a)	Explain the composition of Nodular CI characteristics and list uses of it.	<i>Explanation relevant to characteristics and composition 6marks and uses 4marks</i>	6+4=10M
3(b)	Which metal is used for manufacturing of helical spring and why	<i>Explanation 3marks and 2marks for composition .</i>	3+2=5M
3(c)	Which steel is used in manufacturing of agricultural equipments ?Justify	<i>list of carbon steel 2 marks 3 marks for Explanation relevant to characteristics and composition</i>	2+3=5M
4(a)	What are tool steels. Classify tool steels	<i>Tool steel explanation 2 marks and each classification 2 marks</i>	2+2*4=10M
4(b)	Why drill bits are made up of high carbon steel? Justify?	<i>Explanation relevant to characteristics and composition</i>	5M
4(c)	Answer the following in Yes or No	<i>1 marks for each answer</i>	1*5=5M

SECTION III

5(a)	Transmission Gears, Railway track are which metal? Justify the selection	<i>Mention of material 2 marks explanation relevant to characteristics 3 marks and composition 5 marks</i>	2+3+5=10M
5(b)	Develop short notes on Austenitic Stainless	<i>Explanation relevant to characteristics and composition</i>	5M
5(c)	Analyse and infer the following designation :el/CI:	<i>2.5 marks for FG200 and 2.5 marks for 30C8</i>	2.5+2.5=5M
6(a)	Which tool steel is used for piercing dies and coining dies? Justify the selection	<i>5 marks for Air hardening and 5 marks for High carbon .</i>	5+5=10M
6(b)	Distinguish between Brass and Bronze	<i>1 marks for each difference. (Any five difference)</i>	1*5=5M

6(c)	Write the Nickel alloy used in manufacturing of	<i>1 marks for each nickel alloy.</i>	1*5=5M
7(a)	List different Bearing materials? Explain Cadmium Bearing Material	<i>5 marks for list of bearing materials 2 marks for composition 3 marks for explanation</i>	(5+2+3=10)
7(b)	Compare Thermo plastics with Thermosetting plastics.	<i>1 marks for each difference. (Any five difference)</i>	1*5=5M
7(c)	What type of smart materials used in Automotive industries & justify the Application of smart material.	<i>2 marks for list of materials 3 marks for applications .</i>	2+3=5M
8(a)	Explain Polymers & list its characteristics and applications.	<i>2 marks for explanation of polymer, 3 marks for characteristics and 5 marks for applications (any 3 characteristics and any 5 applications )</i>	2+3+5=10M
8(b)	List different properties of ceramic materials and explain any one	<i>2 marks for list of properties , 3 marks for explanation of any one properties</i>	2+3=5M
8(c)	Wings of Aircraft is made of which composite material and why?	<i>2 marks for list of materials 3 marks for explanation.</i>	2+3=5M

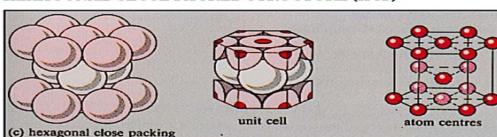
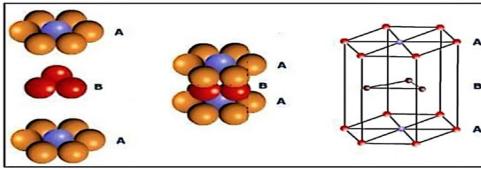
**SECTION V**

9(a)	Cutting edges of drill & saws are slowly accurately reheated & Quenched. Suggest suitable heat treatment process and list Different types of heat treatment process.	<i>2 marks for list of materials 3 marks for explanation 5 marks for list of heat treatment process(list any 5 heat treatment process)</i>	2+3+5M
9(b)	Write 5 differences between dry chemical corrosion and wet Chemical corrosion	<i>1 marks for each difference. (Any five difference)</i>	1*5=5M
9(c)	What are the factors influencing corrosion	<i>1 marks for each factors. (Any five factors)</i>	1*5=5M
10(a)	A product is manufactured using GI-Iron sheet for good appearance and avoids corrosion. Which process is adopted? Explain.	<i>5 marks for process 5marks for explanation.</i>	5+5=10M
10(b)	What are electrolytes? Name different types	<i>3 marks explanation 2 marks for types.</i>	3+2=5M
10(c)	Explain the construction and working of Electro chemical cell?	<i>3 marks explanation 2 marks for sketch.</i>	3+2=5M

**MATERIALS FOR ENGINEERING****Instructions:** (i) Answer one full question from each section.

(ii) One full question carries 20 marks.

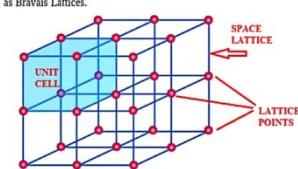
**SECTION I**

1	(a)	<b>List Engineering Materials on basis of natural and man made existence</b>	<b>05M</b>
		<ul style="list-style-type: none"> <li>• Metals and alloys-ferrous metals &amp; non ferrous metals Ferrous metals –carbon steels, stainless steel, tool steel.</li> <li>Non ferrous metals-brass, bronze, ,aluminum, copper, silver, gold</li> <li>• Ceramics and glasses-silica,soda lime,glass,concrete</li> <li>• Organic polymers-PVC,PTFE,nylon</li> <li>• Composites – Fiber reinforced plastic,Steel reinforced concrete.</li> </ul> <p><i>Scheme : 1 marks for each materials (list five materials)(1*5=5)</i></p>	1*5=5M
	(b)	<b>Name the crystal structures.which structure is generally found in Zirconium &amp; Beryllium?</b>	<b>05M</b>
		<p>In this type of structure, the unit cell, which is in the shape of hexagon,contains one atom at each corner of the hexagonal prism, one atom at the centre of the hexagonal faces and three more atoms within the body of the cell It is the obvious that each unit cell shares 14 atoms with the neighboring unit cells. This type of unit cell is found in metals like magnesium,zinc,titanium,zirconium,beryllium, and cadmium etc,</p> <p><b>HEXAGONAL CLOSE PACKED STRUCTURE (HCP)</b></p>   <p><i>Scheme : Explanation 4 marks and 1 marks for sketch.)(4+1=5) Full marks can be given for good explanation without sketch also</i></p>	04M 01M

1	(c)	<b>Explain Malleability and Ductility with suitable examples</b>	<b>05M</b>
		<b>Malleability:</b> It is the property of metal by virtue of the capability of being shaped into thin sheets Or extended by hammering, forging etc. Examples: Gold,iron,aluminium,copper,silver and lead.	

	<p><b>Ductility:</b> It is the property of metal by virtue of which it can be drawn into wires(or elongated) before rupture takes place. It depends upon the grain size of the metal crystals. Ductility of a metal can be measured by its percentage elongation and percentage</p> <p><b>Scheme :</b> Malleability definition with examples 2.5marks and Ductility definition with examples 2.5marks(2.5+2.5=5)</p>	
	<b>(d)</b> Explain briefly etching process of specimen preparation	<b>5M</b>
	<p>A Finely polished specimen, under microscopic examination, will reveal only a few structural features such as inclusions and cracks or other physical imperfections. But it will not reveal the required micro structural features or phases present in the material. This limitation of the polishing is overcome by employing the operation called etching. Etching is the operation carried out on the specimen to optically enhance Micro structural features of the material(grain size, phase features,etc) and the phases present in the material</p> <p><b>Scheme :</b> Explanation 5mark, Full marks can be given for good explanation</p>	
2	<b>(a)</b> Explain any five mechanical properties of metal	<b>05M</b>
	<p><b>Elasticity:</b> It is the property of a metal by virtue of which it can retain its original shape and size after the removal of the load. In nature, no materials is perfectly elastic, over the entire range of stress, up to rupture.</p> <p><b>Plasticity:</b> It is the property of a metal by virtue of which a permanent deformation(without fracture) takes place, whenever it is subjected to the action of external forces</p> <p><b>Ductility:</b> It is the property of a metal by virtue of which it can be drawn into wires(or elongated) before rupture takes place</p> <p><b>Brittleness:</b> It is defined as the property of a metal by virtue which it will fracture without any appreciable deformation. this property is opposite to the ductility of a metal.</p> <p><b>Hardness:</b> It is defined as the property of a metal by virtue of which it can be resist abrasion, indentation(or penetration) and scratching by harder bodies. It is measured by the resistance of the metal which it offers to Scratching.</p> <p><b>Toughness:</b> It is defined as the property of a metal by virtue of which it can absorb maximum energy before fracture takes place. The area under stress-strain curve indicates the toughness.</p> <p><b>Stiffness:</b> It is defined as the property pf a metal by virtue of which it resists deformation. Stiffness of a metal is measured by its modulus of Elasticity.</p> <p><b>Resilience:</b> It is defined as the property of a metal by virtue of which it stores</p>	

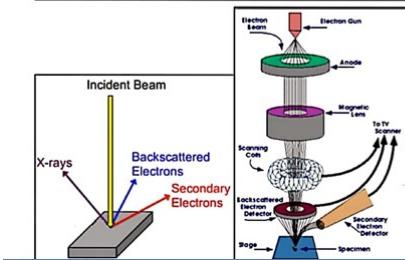
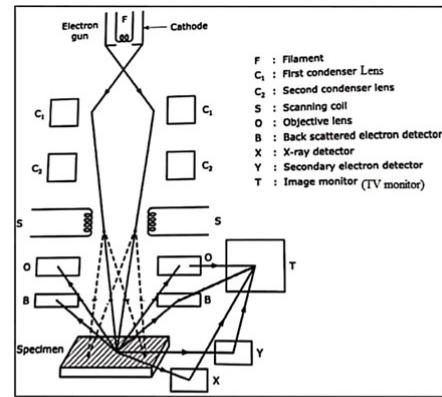
	<p>energy and resist shocks or impacts. The resilience of a metal is measured by the amount of energy that can be stored per unit volume, after it is stressed up to elastic limit.</p> <p><b>Creep:</b> It is defined as the property of a metal by virtue of which it deforms continuously under a steady load. Generally, the creep occurs in steel at higher temperatures</p> <p><b>Endurance:</b> It is defined as the property of metal by virtue of which it can withstand varying stresses(same or opposite nature). the maximum value of stress that can be applied for an indefinite time, without causing its failure, is known as endurance limit</p> <p><b>Strength:</b> It is defined as the property of a metal by virtue which it can withstand or support an external force or load without rupture. The strength of a metal is the most important property, which plays a decisive role in designing various structures and components.</p> <p><b>Scheme :</b> 1 marks for each properties (Any five properties)(1*5=5)</p>	
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2	(b)	<b>Define Crystal lattice and unit cell</b>	<b>5M</b>
		<p><b>Crystal Lattice:</b></p> <p>We know that crystals are made up of a regular, repetitive arrangement of their atoms in a three dimensional pattern. When each atom is replaced by a point, then such an arrangement of points in three dimensional pattern is known as crystal lattice or space lattice. Each point that replaces an atom is called lattice point.</p> <p><b>Unit cell:</b></p> <p>The metallic crystals can be considered as consisting of tiny blocks which are repeated in three dimensional pattern. This tiny block, which is formed by the arrangement of a small group of atoms is called, unit cell.</p> 	02M
			02M
			01M

**Scheme : 2 marks for crystal lattice 2 marks for unit cell and 1 marks for sketch(2+2+1=5)**

2	(c)	<b>Explain briefly scanning electron microscope</b>	<b>05M</b>
		<p>A scanning electron microscope(SEM) is a type of electron microscope which is used to produce images of a metallographic sample. These images are later studied and analyzed to interpret the topography, crystallographic structure, composition of the specimen basically consists of:</p> <ul style="list-style-type: none"> <li>Electron gun</li> <li>Condenser lenses</li> <li>Scan coils</li> <li>Detectors</li> <li>Sample Chamber</li> </ul> <p>A high energy beam is produced using an electron gun. Electron beam thus produced is focused using a series of condenser lenses as it moves from the</p>	03M

source towards the specimen. Focusing is essential to obtain a narrower electron beam which helps in scanning the specimen.



**Scheme : Explanation 3 mark and 2 marks for the sketch.(3+2=5)**  
**Full marks can be given for good explanation without sketch also**

02M

2	(d) Compare crystalline material with non crystalline material	05M
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Crystalline solids are those solids in which atoms are arranged in a regular and orderly pattern, resulting in a definite shape i.e., arrangement of atoms is in a periodically repeating pattern. Eg: All metals, Sodium chloride, Sodium nitrate, Diamond etc.

Non-Crystalline solids are those solids in which atoms are not arranged in any specific order i.e., atoms are randomly scattered in space without showing any regular repeating pattern. Eg: Glass, Rubber, Gels etc

**Scheme : 2 marks for crystalline and 2 marks for non crystalline and 1 marks for examples (2+2+1=5)**

## SECTION II

3	(a) Explain the composition of Nodular CI characteristics and list uses of it.	10M
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Unlike long flakes has in Gray cast iron graphite appears as rounded particles or nodules or spheroid in nodular cast iron. The properties of nodular cast iron depends upon the metal composition and the cooling rate. Nodular cast iron possesses very good machinability. Soft annealed grades of nodular cast iron can be turned at a very High feeds and speeds.

Nodular cast iron contains

4.2% Carbon (co 2)  
 3.5% Silicon (Si)  
 0.3 – 0.8% Manganese (Mn)  
 0.08% Phosphorus (P) and  
 0.2% Sulphur (s)

It possesses excellent damping capacity, cast ability and wear resistance

	<p><b>USES:</b></p> <ol style="list-style-type: none"> <li>1. Crank shaft</li> <li>2. Pipes</li> <li>3. Spindle</li> <li>4. Hypoid axle gears</li> <li>5. Tractors</li> </ol> <p><i>Scheme : Explanation relevant to characteristics and composition 6marks and uses 4marks (6+4=10)</i></p>	
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3 (b)	<b>Which metal is used for manufacturing of helical spring and why</b>	05M
	<p>Spring steel is a name given to a wide range of steels used in the manufacture of springs, prominently in automotive and industrial suspension applications. These steels are generally low-alloy manganese, medium-carbon steel or high-carbon steel with a very high yield strength. This allows objects made of spring steel to return to their original shape despite significant deflection or twisting.</p> <p><b>Hyper-eutectoid spring steels.</b></p> <p>This type of steel contains</p> <ul style="list-style-type: none"> <li>• C = 0.9 to 1.2%, Si = 0.3% (max) and Mn = 0.45 to 0.70%.</li> <li>• These steels are oil quenched and tempered at low temperature.</li> <li>• This type of steel is used for volute and helical springs.</li> </ul> <p><i>Scheme : Explanation 3marks and 2marks for composition . (3+2=5)</i></p>	
3 (c)	<b>Which steel is used in manufacturing of agricultural equipments ?Justify</b>	05M
	<p>Steel used in the agriculture and farming industry.</p> <p><b>Low carbon steel</b> (steel consists of less than 0.30% carbon): Used extensively in the construction of farm machinery. Frames and most of other members are made out of low-carbon steel.</p> <p><b>Medium carbon steel</b> (Medium-carbon steel consists of 0.30% to 0.60% carbon) for greater strength and hardness“ Low and carbon Steel is found in a variety of farming equipment</p> <p><i>Scheme : list of carbon steel 2 marks 3 marks for Explanation relevant to characteristics and composition (2+3=5)</i></p>	
4 (a)	<b>What are tool steels. Classify tool steels</b>	10M
	<p>Tool steels are high-quality, carbon and alloy steels that are commonly used to make cutters, reamers, bits etc used for machining metals, plastics, and wood. The Carbon content in tool steel in the range of 0.1 -1.6%. Tool steel also contain alloying elements like, Chromium, Molybdenum and Vanadium. Tool steel offers better durability, strength, corrosion resistance and temperature stability, as compared to the Construction &amp; Engineering.</p> <p><b>Classification of tool steels:</b></p> <ol style="list-style-type: none"> <li>1) Cold work tool steels             <ol style="list-style-type: none"> <li>a) Oil-hardening cold-work steels</li> <li>b) Air-hardening cold-work steels</li> <li>c) High-carbon, high-chromium cold-work steels</li> </ol> </li> </ol>	

	<p>2) Hot work tool steels</p> <ul style="list-style-type: none"> <li>a) Chromium hot work steels</li> <li>b) Tungsten hot work steels</li> <li>c) Molybdenum hot work steels</li> </ul> <p>3) High-speed tool steels</p> <ul style="list-style-type: none"> <li>a) Molybdenum high-speed steels</li> <li>b) Tungsten high-speed steels</li> </ul> <p>4) Other types of tool steels include:</p> <ul style="list-style-type: none"> <li>a) Water-hardening tool steels</li> <li>b) Shock-resistant tool steels</li> <li>c) Low-carbon tool steels</li> <li>d) Low-alloy special purpose tool steels</li> </ul> <p><i>Scheme : Tool steel explanation 2 marks and each classification 2 marks (2+2*4=8)=10 marks .</i></p>	
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4	(b)	<b>Why drill bits are made up of high carbon steel? Justify?</b>	<b>05M</b>
		<p>High carbon steel contains the following.</p> <p>Steel containing 0.7 to 1.5% carbon is known as high carbon steel.</p> <p>High C content provides high hardness and strength.</p> <p>Used in hardened and tempered condition</p> <p>Strong carbide formers like Cr, V, W are added as alloying elements to form carbides of these metals. it has the properties of</p> <p>High hardness, High strength, Least ductile, High wear resistance. so high carbon steel is used for manufacturing of drill bits</p>	
<i>Scheme : Explanation relevant to characteristics and composition 5marks</i>			
4	(c)	<b>Answer the following in Yes or No</b>	<b>05M</b>
		<p><b>Explain the following processes</b></p> <p>(a). Copper is an alloy-NO</p> <p>(b). Steel wire is more elastic than rubber- YES</p> <p>(c). Glass is brittle- YES</p> <p>(d). Aluminum is heavier than iron- NO</p> <p>(e). Gun metal is a ferrous metal- NO</p>	1*5=5M
<i>Scheme : 1 marks for each answer (1*5=5)</i>			

### SECTION III

5	(a)	<b>Transmission Gears, Railway track are which metal? Justify the selection</b>	<b>10M</b>
		<p>Transmission gears and railway track are made of malleable cast iron .</p> <p>Malleable iron is cast as white iron, the structure being a metastable carbide in a pearlitic matrix. Through an annealing heat treatment, the brittle structure as first cast is transformed into the malleable form.</p> <p>Characteristics</p> <ul style="list-style-type: none"> <li>• Malleable iron starts as a white iron casting that is then heat treated at about 900oC</li> <li>• Malleable cast iron is obtained from the hard and brittle white iron through a</li> </ul>	

		<p>controlled heat conversion process</p> <ul style="list-style-type: none"> <li>• Malleable cast iron is one which can be hammered and rolled to obtain different shapes</li> <li>• Malleable cast iron possesses high yield strength</li> <li>• Malleable cast iron contains           <ul style="list-style-type: none"> <li>➤ 2.3% Carbon (C)</li> <li>➤ 0.6 - 1.3% Silicon (Si)</li> <li>➤ 0.2 - 0.6 % Manganese (Mn)</li> <li>➤ 0.15% Phosphorus (P) and</li> <li>➤ 0.1% Sulphur (s)</li> </ul> </li> </ul> <p>Solidification range of 2552 to 2065 F</p> <p><b>Scheme : Mention of material 2 marks explanation relevant to characteristics 3 marks and composition 5 marks .(2+3+5=10)</b></p>	
5	(b)	<b>Develop short notes on Austenitic Stainless Steel</b>	<b>5M</b>
		<p><b>Austenitic Stainless Steels:</b></p> <ul style="list-style-type: none"> <li>• These contain at least 24% chromium and nickel combined. These are non hardenable and non-magnetic.</li> <li>• These are highly resistant to many acids, strong and scale less than any of the plain chromium alloys.</li> <li>• These are very useful for parts subjected to severe stress at elevated temperatures.</li> <li>• These find uses in food processing, dairy industry, textile industry, Pharmaceuticals.</li> </ul> <p><b>Scheme:Explanation relevant to characteristics and composition 5marks Full marks can be given for good explanation</b></p>	
5	(c)	<b>Analyse and infer the following designation of Steel/CI:</b>	<b>5M</b>
		<p>Designation Grey Cast iron: Grey cast iron specified by FG followed by its tensile strength.</p> <p>1)FG200 that means grey cast iron with ultimate tensile strength 200 N/mm<sup>2</sup>. Cylinder block, brake drum, clutch plate etc. are made from Grey Cast iron .</p> <p>2)30C8 Where, 30 = 100 times average % of Carbon    8 = 100 times average % of Manganese    Average % of Carbon = 30/100 = 0.3%    Average % of Manganese = 8/100 = 0.08%</p> <p><b>Scheme : 2.5 marks for FG200 and 2.5 marks for 30C8 (2.5+2.5=5)</b></p>	
6	(a)	<b>Which tool steel is used for piercing dies and coining dies? Justify the selection</b>	<b>10M</b>
		<p><b>Air-hardening cold-work steels (Symbol A):</b></p> <ul style="list-style-type: none"> <li>• Air-hardening cold-work steels are hardened by air cooling.</li> <li>• These steels contain Carbon (1.0%) with manganese, chromium &amp; molybdenum &amp; tungsten.</li> <li>• These are characterized by high wear resistance &amp; high hardenability, fair red hardness, good toughness &amp; resistance to decarburization.</li> <li>• Tempering temperature for these steels varies from 150- 425°C. Applications are Knives, Blanking &amp; trimming dies and coining dies.</li> </ul>	

		<p><b>High-carbon, high-chromium cold-work steels (Symbol D):</b></p> <ul style="list-style-type: none"> <li>• High-carbon, high-chromium cold-work steels are hardened by oil- or airhardening.</li> <li>• These steels contain Carbon is 1.4-2.3% &amp; Chromium is 12-14%, with molybdenum, cobalt, vanadium.</li> <li>• These are characterized by high hardness, wear &amp; abrasion resistance.</li> <li>• Tempering temperature for these steels varies from 150- 375°C.</li> <li>• Applications are Mandrel for tube rolling by Pilger rolls, Blanking &amp; piercing dies, Drawing dies.</li> </ul> <p><i>Scheme : 5 marks for Air hardening and 5 marks for High carbon . Full marks can be given for good explanation with suitable points(5+5=10)</i></p>	
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6	(b)	<b>Distinguish between Brass and Bronze.</b>	<b>05M</b>
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6	(c)	<b>Write the Nickel alloy used in manufacturing of</b>	<b>5M</b>
		(i) Costume Jewellery - <b>German silver</b> (ii) Furnace geysers - <b>Nichrome</b> (iii) Pump fitting, Steam turbine blades - <b>Monel metal</b> (iv) Aircraft engine - <b>Inconel</b> (v) Turbine engine - <b>Nimonics</b> <p><i>Scheme : 1 marks for each nickel alloy.(1*5=5)</i></p>	

#### SECTION IV

7	(a)	<b>List different Bearing materials? Explain Cadmium Bearing Material</b>	<b>10M</b>
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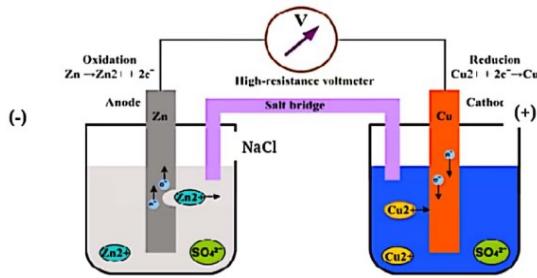
		<p>(i). Babbitt material      a. Tin based babbitt      b. Lead based babbitt</p> <p>(ii).Copper based alloys      (iii).Cadmium based alloys      (iv).Aluminium based alloys      (v). Silver based alloys      (vi).Non-metallic bearing materials</p> <p><b>Cadmium based alloys:</b>      Composition: 97% Cadmium(Cd)      2% Nickel(Ni)      Silver(Ag),Copper(Cu)&amp;Zinc(Zn) are added in      Smaller percentage</p> <p>These alloys aren't very popular because of high price of cadmium. These bearing alloy possess greater compressive strength than tin bearing alloys.      Cadmium based alloys possess (a) low coefficient of friction, (b) high Fatigue strength, (c) high load carrying capacity, (d) low wear, (e)fair Ability to embed dirt, and (f) poor corrosion resistance</p> <p><b>Uses:</b> Medium loaded bearing subjected to high temperature and used In automobile and aircraft industries.</p> <p><b>Scheme :</b> 5 marks for list of bearing materials 2 marks for composition 3 marks for explanation .(5+2+3=10)</p>																	
7	(b)	<b>Compare Thermo plastics with Thermosetting plastics.</b>	<b>5M</b>																
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7	(c)	<b>What type of smart materials used in Automotive industries &amp; justify the Application of smart material.</b>	<b>5M</b>																
		<p>Smart or intelligent materials are materials that have to respond to stimuli and environmental changes and to activate their functions according to those changes. The stimuli like temperature, pressure, electric flow ,magnetic flow, light, mechanical etc. can originate internally or externally .</p> <p><b>Thermo responsive Materials</b> are used in Automotive industries.</p> <p>Thermo responsive material has the ability to change properties in response to change in temperature .</p>																	

		<p>Application of smart materials are:</p> <ul style="list-style-type: none"> <li>(i) Aerospace</li> <li>(ii) Mass transit</li> <li>(iii) Marine</li> <li>(iv) Automotive</li> <li>(v) Computers and other electronic devices</li> <li>(vi) Consumer goods applications</li> <li>(vii) Civil engineering</li> <li>(viii) Medical equipment application</li> <li>(ix) Rotating machinery application</li> </ul> <p><i>Scheme : 2 marks for list of materials 3 marks for applications .(2+3=5)</i></p>	
8	(a)	<p><b>Explain Polymers &amp; list its characteristics and applications.</b></p>	<b>10M</b>
		<p>A polymer is a large molecule of which is formed by repeated linking of the small molecules called “monomers”. Polymers can be natural or synthetic. All plastics are polymers, but not all polymers are plastic</p> <p><b>Characteristics of polymers</b></p> <ul style="list-style-type: none"> <li>(i) Low density</li> <li>(ii) Low coefficient of friction</li> <li>(iii) Good corrosion resistance</li> <li>(iv) Good mould ability</li> <li>(v) Excellent surface finish can be obtained</li> <li>(vi) Can be produced with close dimensional tolerances</li> <li>(vii) Economical</li> <li>(viii) Poor tensile strength</li> <li>(ix) Low mechanical properties</li> <li>(x) Poor temperature resistance</li> <li>(xi) Can be produced transparent or in different colours</li> <li>(xii) Low melting point</li> </ul> <p><b>Applications of polymers</b></p> <ul style="list-style-type: none"> <li>(i) These are used in adhesives, paints and textile coatings</li> <li>(ii) Used for bottles, trays, table wears</li> <li>(iii) Used for wire insulation, floor coverings, water and drain pipes</li> <li>(iv) Polymers are used to prepare non stick surface and plumbing Tapes</li> <li>(v) Polymers are used for household products</li> <li>(vi) These are used to give chemical resistance coating in containers</li> <li>(vii) Used for gloves, rubber bands and conveyor belts</li> <li>(viii) Used in oil and gasoline resistance rubber</li> <li>(ix) Used for manufacturing the tires and fibres</li> <li>(x) Used for manufacturing the synthetic leather and food wrapper</li> </ul> <p><i>Scheme : 2 marks for explanation of polymer, 3 marks for characteristics and 5 marks for applications (any 3 characteristics and any 5 applications )(2+3+5=10)</i></p>	
8	(b)	<p><b>List different properties of ceramic materials and explain any one</b></p>	<b>5M</b>

	<p><b>Properties of ceramic materials</b></p> <ul style="list-style-type: none"> <li>(i) Mechanical properties</li> <li>(ii) Electrical properties</li> <li>(iii) Thermal properties</li> </ul> <p><b>(i) Mechanical properties</b></p> <p>The compressive strength is several times more than the tensile strength Non-ductile/brittle</p> <p>Below recrystallization temperature, non-crystalline ceramics are fully brittle</p> <p>At high temperature rigidity is high</p> <p>The elastic modulus (young's modulus) of ceramics is usually higher than for metals, because ceramics are bonded either covalently or ionically. This bonding is stronger than metallic bonding.</p> <p><b>(ii) Electrical properties</b></p> <p>In contrast to metals, Ceramics have very low electrical conductivity</p> <p>Electrical Insulators fall into two general classification:</p> <ul style="list-style-type: none"> <li>(a) Classical Electrical Procelain-for both high and low Tension service</li> <li>(b) Special bodies such as rutile, high alumina - for high Frequency insulation.</li> </ul> <p>Most of the ceramics have dielectric strength, it is the ability of material to withstand Electrical breakdown</p> <p><b>(iii) Thermal properties</b></p> <p>The ceramic materials have a low thermal conductivity</p> <p>Thermal shock resistance is the ability of a material to resist Cracking or disintegration of the material under abrupt of Sudden change in temperature</p> <p>The coefficient of expansion is low.</p> <p><i>Scheme : 2 marks for list of properties , 3 marks for explanation of any one properties(2+3=5)</i></p>	
8	<b>(c) Wings of Aircraft is made of which composite material and why?</b>	<b>5M</b>
	<p>Wings of Aircraft is made in Sandwich panels.</p> <p>Because these composites are composed of two strong outer sheets or faces (typical face materials include aluminium alloys, fibre reinforced plastics, titanium steels and plywood), separated by a layer of less dense material or "core" (typical core materials include foamed polymers, synthetic rubbers, inorganic cements and wood) which has lower stiffness and lower strength. The core, structurally perform following two functions</p> <ul style="list-style-type: none"> <li>(i) It separates the face and resists deformation perpendicular to the face plane</li> <li>(ii) It provides a certain degree of shear rigidity along planes Which are perpendicular to the faces</li> </ul> <p><i>Scheme :2 marks for list of materials 3 marks for explanation.(2+3=5)</i></p>	
<b>SECTION V</b>		
9	<b>(a) Cutting edges of drill &amp; saws are slowly accurately reheated &amp; Quenched. Suggest suitable heat treatment process and list Different types of heat treatment process.</b>	<b>10M</b>

	<p><b>Hardening</b> is the heat process for cutting edges of drill &amp; saws Accurately reheated and quenched.</p> <p>Hardening is defined as heat treating process in which the steel is heated to a temperature within or above critical temperature, held at this temperature for considerable time to ensure penetration of temperature inside the component and then allowed to cool by quenching in water, oil or brine solution</p> <p><b>Types of heat treatment process:</b></p> <ul style="list-style-type: none"> <li>Annealing</li> <li>Normalising</li> <li>Hardening</li> <li>Tempering</li> <li>Case hardening           <ul style="list-style-type: none"> <li>a. Carburizing</li> <li>b. Cyaniding</li> <li>c. Nitriding</li> </ul> </li> <li>Surface hardening           <ul style="list-style-type: none"> <li>a. Induction hardening</li> <li>b. Flame hardening</li> </ul> </li> <li>Diffusion coatings</li> </ul> <p><i>Scheme : 2 marks for list of materials 3 marks for explanation 5 marks for list of heat treatment process(list any 5 heat treatment process)(2+3+5=10)</i></p>																	
9	(b) <b>Write 5 differences between dry chemical corrosion and wet Chemical corrosion</b>																	
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9	(c) <b>What are the factors influencing corrosion</b>	<b>5M</b>																
	<p><b>The factors influencing corrosion are:</b></p> <ul style="list-style-type: none"> <li>(a) Nature of the metal</li> <li>(i) Physical state</li> </ul>																	

		<p>(ii) Purity of metal      (iii) Over voltage      (iv) Nature of surface film      (v) Relative areas of the anodic and cathodic parts      (vi) Position in galvanic series      (vii) Passive character of metal      (viii) Solubility of corrosion products      (ix) Volatility of corrosion products</p> <p>(b) Nature of the corroding environment      (i) Temperature      (ii) Humidity of air      (iii) Presence of impurities in atmosphere      (iv) Presence of suspended particles in atmosphere      (v) Influence of pH      (vi) Nature of ions present      (vii) Conductance of the corroding medium      (viii) Formation of oxygen concentration cell      (ix) Flow velocity of process steam      (x) Polarization of electrodes</p>	
<i>Scheme : 1 marks for each factors. (Any five factors)(1*5=5)</i>			
10	(a)	<b>A product is manufactured using GI-Iron sheet for good appearance and avoids corrosion. Which process is adopted? Explain.</b>	<b>10M</b>
		<p>Galvanizing process is adopted for a product is manufactured Using GI- Iron sheet for good appearance and avoid corrosion.</p> <p>The hot dip galvanizing process is relatively simple. It Involves cleaning steel and immersing it in molten zinc to Obtain a coating. Hot dip galvanizing is the process of Coating iron or steel with a layer of molten zinc at a .Temperature of around 450 C for good appearance.</p>	
<i>Scheme : 5 marks for process 5marks for explanation.(5+5=10) Full marks can be given for good explanation .</i>			
10	(b)	<b>What are electrolytes? Name different types</b>	<b>05M</b>
		<p>An electrolyte is a substance that dissociates in water into Charged ions are called cations. Negatively charged ions are Called anions. Simply,an electrolyte is a substance that can Conduct an electric current when melted or dissolved in water.Ex:Acids,Bases and salts are electrolyte</p> <p><b>Types of electrolyte</b></p> <ul style="list-style-type: none"> <li>(i) Strong electrolyte</li> <li>(ii) Weak electrolyte</li> </ul>	
<i>Scheme :3 marks explanation 2 marks for types.(3+2=5)</i>			
10	(c)	<b>Explain the construction and working of Electro chemical cell?</b>	<b>5M</b>



ELECTRO CHEMICAL CELL

Electrochemical cells have two conductive electrodes, called the anode (denoted by negative sign) and the cathode (denoted by positive sign) dipped inside two separate containers. Zinc rod dipped in zinc sulphate solution acts as anode. Copper rod dipped in copper sulphate solution acts as cathode. Electrodes can be made from any sufficiently conductive materials, such as metals, semiconductors, graphite, and even conductive polymers. Electrodes are connected by wire, through which electron passes. An inverted U tube, whose either ends comes in contact with electrolyte of both the containers acts as a bridge.

Salt bridge is usually an inverted U-tube filled with concentrated solution of inert electrolytes. An inert electrolyte is one whose ions neither involved in any electrochemical change nor do they react chemically with the electrolytes in two half cells. Generally salts like KCl, KNO<sub>3</sub>, K<sub>2</sub>SO<sub>4</sub> etc.

**Scheme :3 marks explanation 2 marks for sketch.(3+2=5)**