Subject Code : 12044 **Model Answer**

Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.

2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.

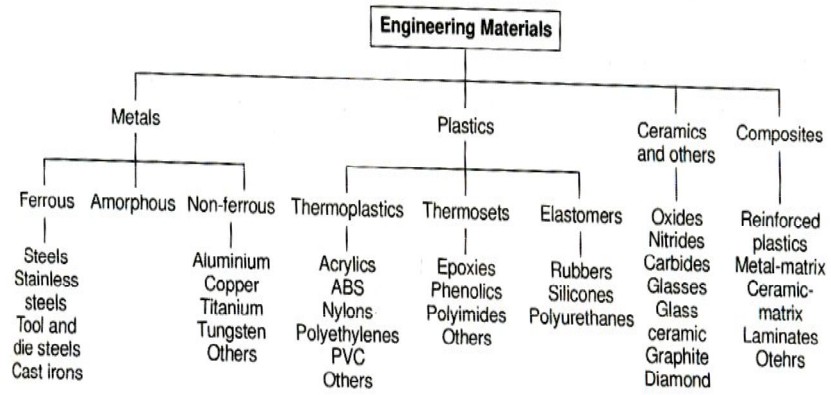
3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills).

4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.

5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.

6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.

7) For programming language papers, credit may be given to any other program based on equivalent concept.

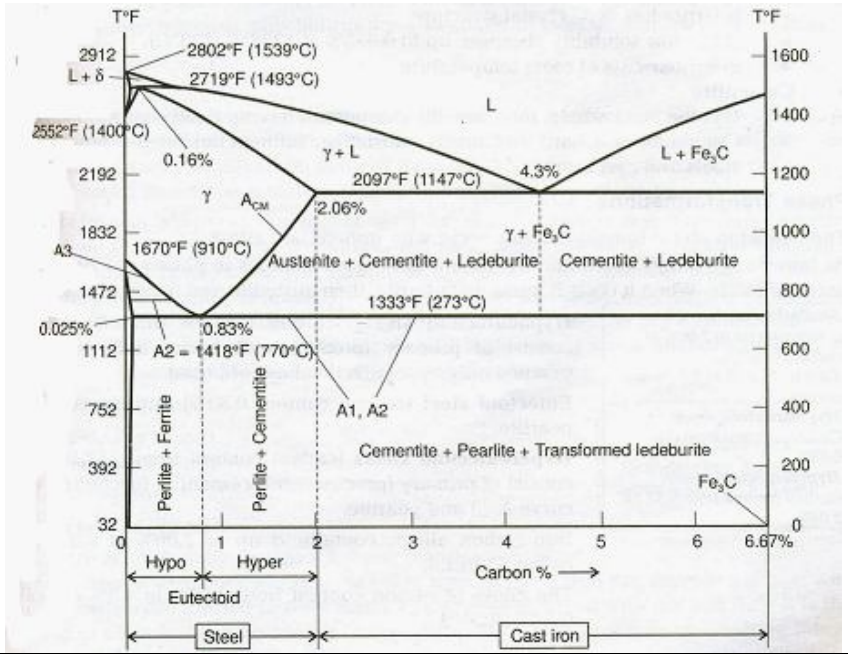
Que. No	Sub Qu. No.	Step by step Solution/ Correct Answer etc.	Max. Marks for Qu./ Sub Qu.
Q. 1	**a)**	Most of the engineering materials may be classified as under.  **General classification of engineering materials**	**02 Marks**
	b)	Applications of Engineering Materials**. (Any Four Applications)** • Automobile Industries :-Making shafts, axles, gears, crankshafts etc. • Railway wheels and rail axles. • In Manufacturing Industries :-Making forging Dies, Die blocks etc • Pipes and couplings.etc.	**½ Mark each**
	c)	**Hardness** is defined as the ability of a material to resist scratching, abrasion, cutting or penetration .Hardness is also measured by resistance to wear of a material. **Toughness** is defined as the amount of energy a material can absorb without breaking or fracture.	**01 mark** **01 mark**
	d)	**Characteristics of Ferrous material (Any Four)** 1. Ferrous metals are metals or metal alloys that contain the iron as a base. 2. Ferrous metals are good conductor of heat and electricity. 3 Ferrous Metal alloys have high resistance to shear,	**½ Mark each**

		torque and deformation. 4. The thermal conductivity of metal is useful for containers to heat materials over a flame. 5. Corrosion resistance properties makes them useful in food processing plant e.g. Steel. 6. Cast iron is strong but brittle and its compressive strength is very high, so used in casting, engine body , machine base. 7. Mild steel is soft, ductile and has high tensile strength. 8. Carbon steel are used for cutting tool due to their great hardness, strength and corrosion resistance.	
	e)	**Application of Wrought Iron (Any Four)** 1. Building Construction : Underground service lines and electrical conduct. 2. Public works : Bridge railings, blast plates drainage lines. 3. Industrial : Condenser tubes, heat exchangers acid and alkaline process lines. 4. Rail road and marine: Diesel exhaust and air brake piping 5. Others : Coal handling equipment, cooling towers etc.	**½ Mark each**
	f)	**Advantages of Alloy steel (Any Four)** 1. It has greater hardenability. 2. It has less distortion and cracking. 3. It has greater ductility at high strength. 4. It has greater high temperature strength. 5. It has greater stress relief at given hardness. 6. It has better machinability at high hardness. 7. It has high elastic ratio and endurance strength.	**½ Mark each**

	g)	**Properties of Cupro-nickel. (Any Four)** 1. It has excellent corrosion resistance. 2. It has good electrical conductivity. 3. It is silver colored alloy. 4. It has high ductility. 5. It has high ductile strength, high tensile strength. 6. It is good conductor of heat.	**½ Mark each**
	h)	Chemical composition of Gun Metal; 88% Cu,10% Tin and 2% Zink , Zink is added to clean the metal and improve fluidity	**02 Marks**
	i)	Heat treatment is the controlled heating and cooling of metals to alter their physical and mechanical properties without changing the product shape. Or. Heat treatment is a series of operations involving the heating and cooling of metal or alloy in the solid state ,for the purpose of obtaining certain desirable properties. **Needs of Heat Treatment** 1. To refine grain structure. 2. To improve machanibility. 3. To relive internal stresses. 4. To increase strength and wear resistance. 5. To increase corrosion resistance. 6. To increase hardness and toughness of metal surfaces.	**Def. 01 Mark, Needs - any two points 01 marks**
	j)	**Advantages of Flame Hardening. (Any Four)** 1. It is a fastest process. 2. There is less distortion of surface. 3. It is economical and useful method. 4. Large part can be surface hardened economically.	**½ Mark each**

		5. The hardened zone is generally much deeper than that obtained by carburizing. its range from 3 to 6 mm depth. 6. Thinner case (1. mm) can be obtained by increasing the speed of heating and quenching.	
	k)	**General Properties of Plastics. (Any Four)** 1. Light in weight 2. Good corrosion resistance. 3. Good resistance to acid base and moisture. 4. Low thermal and electrical conductivity. 5. Wide range of colours. 6. Low modulus of rigidity. 7. Plastic are reasonably tough and strong but the strength is less than metals.	**½ Mark each**
	l)	**Properties of Tharmocole. (Any Four)** 1) It has excellent insulating properties. 2) It can be cut easily with simple tool like knife or saw. 3) It has high resistance to moisture, adequate structural strength. 4) It has excellent dimensional stability. 5) It has snow white colour and odorless. 6) It is very light in weight. 7) It has fungus resistance.	**½ Mark each**
	m)	**Limitations of Powder metallurgy. (Any Four)** 1) Part made by Powder metallurgy, in most cases do not have as good physical properties as wrought or cast part. 2) Cost of Powder production is high. 3) Relatively high tool and die cost. 4) The size of the products is small as compared to die casting. 5) Complicated shapes cannot be made by Powder metallurgy.	**½ Mark each**

		6) It is not economical for small scale production.	
	n)	**Principal of radiography testing.** This technique involves the use of penetrating gamma or X-radiation to examine parts and products for imperfections. An X-ray machine or radioactive isotopes is used as a source of radiation. Radiation is directed through a part and onto film or other media . The resulting Shadowgraph shows the internal soundness of the part. Possible imperfections are indicated as density changes in the film in the same manner as X-ray shows broken bones.	**02 Marks**
Q. 2	**a)**	Alloying elements are added to achieve certain properties in the material. Following are the alloying elements and their effects . **(Any Four material with Two point each)** 1. Nickel : 1. It increases strength and toughness. 2. It helps to resist corrosion. 3. It improves shock resistance. 4. It increases strength of steel. 2. Tungeston :- 1. It increases Hardness. 2. It promotes fine grains. 3. It increases strength at elevated temperature. 4. It increases heat resistance. 3. Molybdenum : 1. It adds toughness and high strength to steel. 2. It makes steel fine grained.	**01 mark each**

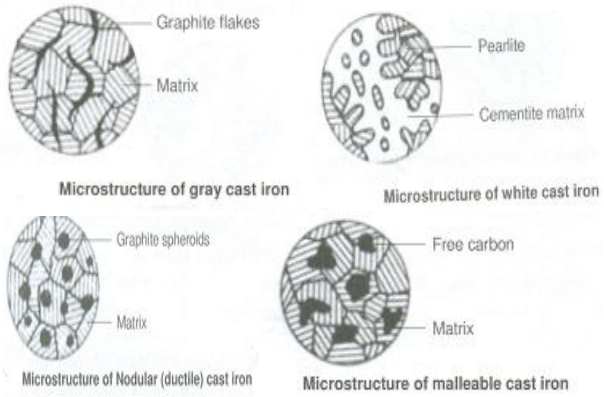
		3. It increases tensile and creep strength at high temperature. 4. It has good creep resistance. 4. Chromium :- 1. It provides corrosion resistance. 2. It increases hardenability. 3. It adds hardness, toughness and resistance to wear. (General effect of addition of alloying elements if written, should be considered)	
	b)	Iron and Iron carbide phase equilibrium diagram  	**Neat Sketch-04 Marks**
	c)	Types of Cast Iron. **(Types -02 Marks, Microstructures any Two -02 Marks)** 1. Gray cast iron	

2. White cast iron

3.Ductile cast iron

4.Malleable cast iron

Microstructure are.



d) Tool steels are steels that are primarily used to make tools used in manufacturing processes as well as for machining metals,woods and plastics.

Characteristics

(02 Marks)

1. It is generally used in a heat treated state.
2. It has carbon content between 0.7% and 1.5%.
3. Tool steels are manufactured under carefully controlled condition to produce tool required quantity.
4. The manganese content is often kept low to minimize the possibility of cracking during water quenching.

Types of Tool Steels.

(02 Marks)

1. High speed Steel (HSS)

Tungsten type high speed steel grades contains 0.65-0.80% carbon,3.75-4.00%chromium,17.25-18.75%

tungsten and 0.9-1.3% vanadium. It includes all molybdenum and tungsten class alloys,

- It is used for punches and dies manufacturing
- It is used making files, chisels, hand plane blades and high quality kitchen and pocket knives.

2. Hot-work Tool Steels

Hot-work tool steels include all chromium,tungsten and molybdenum alloys.

They are typically used for forging,die casting,heading,piercing,trim,extrusion, and hot-shear and punching blades.

3. Cold –work Tool Steels

Cold –work tool steels includes all high –chromium, medium-alloy, air hardening, water hardening and Oil hardening alloys.

4. Shock-resistance Tool Steels.

Shock-resistance Tool Steels includes all class S alloys.

They are among the toughest of the tool steels,and are typically used for screw driver blades, shear blades, chisels, knockout pins, punches and riveting tools.

e) Classification of Magnetic Materials. (Classification 2 marks)

Magnetic Materials can be classified in to two main types as under,

		1) Soft Magnetic Materials. 2) Hard Magnetic Materials. Properties of magnetic material. (**Properties and applications two points each -02 marks.)** 1) Properties and Application of Soft Magnetic Materials :- • These are used in devices where devices are subjected to alternating magnetic fields and in which energy losses must be low i.e. transformer core • Relative area of hysteresis loop is small. • These materials have high magnetic permeability and low coecivity. • These materials have high electrical resistivity. Example :-Motors,generators,Electromagnets and Power Transformer etc.. 2) Properties and Application of Hard Magnetic Materials:- • Hard magnetic materials are utilized in permanent magnets. • These materials have high resistance to demagnetization. • These have High coecivity, low internal permeability and high hysteresis losses. • These have big area of hysteresis loop. Example :-Magnetic Tape, audio cassettes,Floppy discs,Hard discs, ATM cards,Computer and T.V. Monitors etc.	
	f)	**Characteristics of Nodular cast iron. (Any Four Characteristics 02 Marks)** • It has very good machinability. • It can be turned at very high feed and speeds.	

		• It possesses damping capacity in between cast iron and steel. • It possesses excellent casting ability and wear resistance. **Application of Nodular cast iron. (Any Four Applications -02 marks)** • Paper industries machinery. • I.C. engine • Power transmission equipments • Pipes • Pumps and compressors • Construction Machinery • Farm implements and Tractors.	
Q. 3	**(a) Ans**	**Give composition and applications of HSLA** **HSLA :-** High strength low alloy steels are low carbon steels – (0.07 - 0.13 % C) with small (< 0.5 %) additions of Ti, V, Nb & Al. Because of low carbon content, they have good ductility, malleability, formability, toughness & weldability and because of alloying elements, the strength is good. These steels have high strength to weight ratio than the conventional steels of identical carbon content.	02 Marks
		Applications :- Superior mechanical properties of these steels are due to ultrafine grain size, solid solution strengthening of ferrite, precipitation of carbides and nitrides and martenstic or bainitic transformation which is likely to occur in these steels due to increased hardenability because of presence of alloying elements. They have strength in the range of 50 to 80 Kg/mm^2 and are widely used in automotive industry.	02 Marks
	b) Ans	**Explain tungsten carbide as a special cutting tool material.** Tungsten carbide is nothing but cemented carbide. They are made with the help or powder metallurgy. The manufacturing process consists in preparing powder carbides of tungsten (w) mixing this powder with a binder such as cobalt powder, pressing the blended powder into compacts of desired shape and sintering the pressed shapes to obtain consolidation.	04 Marks

		Tungsten carbide tools, more commonly called tipped tools, are the most important cutting tools in machine shops today. Tungsten carbide is the cutting medium. Cobalt powder is used for bonding the tungsten carbide powder. Cobalt fuses at the sintering temperature, whereas the tungsten carbide remains intact. Hence the product is known as cemented tungsten carbide. The microstructure of cemented tungsten carbide shows usually big grains of tungsten carbide and also the segregation of cobalt. It posseses following properties. 1) High hardness & wear resistance. 2) Good resistance to softening by heat. 3) Poor toughness 4) High resistance to oxidation & thermal shock	
	c)	**State desired properties of bearing materials.** 1) Friction between the bearing and the rotating part should be as small as possible to reduce the power loss in transmission. 2) The affinity between the shaft and the bearing material should be minimum. 3) It should have high fatigue resistance. 4) It should have good resistance to galling and seizing. 5) It should have good thermal conductivity. 6) It should have a high oil retaining capacity. 7) It should have good corrosion resistance. 8) It should have sufficient load bearing capacity. 9) It should be hard and wear resistant for longer life. 10) It should have sufficient plasticity and deformability.	04 Marks
	d)	**What is copper? State its properties & applications.** **Copper :-** Copper is one of the metal which has a pleasing reddish colour. It is widely used in electrical industry in the form of wires for electrical conductors. The usual alloying elements added to copper for the improvement of properties are Zn, Al, Sn, P, Si, Ni, Mn, Pb, Mg etc.	01 Marks
		Properties :- 1) Good ductility and malleability. 2) High electrical and thermal conductivity.	1½ Marks

		3) Good corrosion resistance to general atmospheric conditions. 4) Very good machinability. 5) Non-magnetic. 6) It can be soldered, brazed or welded (Any three each carry ½ Mark)	
		Application :- 1) Electrical Parts. 2) Automobile Radiators and gaskets. 3) Household utensils. 4) For roofing. 5) Pressure vessels. 6) Coins. 7) Screw machine products. (Any three each carry ½ Mark)	1½ Marks
	e)	**State any two copper alloys with their properties and applications.** 1) **Brasses :-** Brasses are the alloys of copper and zinc. Brass has high resistance to corrosion and is easily machinable. It also acts as good bearing material. Zinc in the brass increases ductility along with strength. Bran possesses greater strength than copper, however it has a lower thermal and electrical conductivity. **Types of Brasses :-** i) **Gliding metal :** - used for making coins, medals, tokens, fuse caps. ii) **Cartridge brass :-** used for making cartridge and shell cases. iii) **Admiralty brass :-** Tin is added to brass to improve its corrosion resistance, used for tubes and other parts of condensers . iv) **Muntz Metal :-** Used for condenser tubes, ship sheathing, valve stems etc. Similar suitable descriptions	02 Marks
		2) **Bronzes :-** It is a broad term defining an alloy of copper and elements other than zinc, commercially important bronzes are	02 Marks.

		aluminum bronzes, tin bronzes, beryllium bronzes and silicon bronzes, Bronze is basically an alloy of copper and tin. Bronze possesses superior mechanical properties and corrosion resistance than brass. Bronze is comparatively hard and it resists surface wear. Bronze can be shaped or rolled into wire, rod and sheets. **Types of Bronzes :-** i) **Coinage bronze:-** Widely used for making coins . ii) **Gun Metal :-**Widely used for gun barrels and ordnance parts, marine casting, gears, bearing, valve bodies iii) **Phosphor bronze:** - Used for springs, wire gauges, wire brushes, electrical contact, gears and bushings. Similar suitable description	
	f)	**Explain the Y-alloy, duralium with their chemical composition.** **Y-alloy :-** designated by LM 14. This is a high strength aluminium alloy and contains about 4% copper , 2% nickel & 1.5% magnesium .It has an excellent ability to retain the strength at elevated temperatures with fairly good corrosion resistance. It can be easily cast and rolled, but it is chiefly used in the cast form. It is mainly used for pistons and cylinder heads of diesel and high duty petrol engines.	02 marks
		Duralumin :- It is a aluminium copper alloys having copper approx. 4.5% magnesium 0.5 % manganese – 0.5 %. It is a precipitation hardenable alloy and produces good strength after precipitation hardening. It is mainly used for air craft casting and for other highly stressed parts due to its good mechanical properties and shock resistance. The alloy has a moderate corrosion resistance.	02 marks
Q. 4	a)	**Explain any two methods of annealing.** 1) **Full annealing or Conventional Annealing :-** Full annealing implies annealing a ferrous alloy by austenitizing and then cooling	04 Marks.

slowly in the furnace itself through the transformation range. The austenitizing temperature range for hypoeutectoid steels is usually between 723ºC to 910 ºC and for hypereutectoid steels, temperature is 723ºC to 1130 ºC full annealing thus involves.

-Heating steel to proper annealing temperature in the austenitic zone.

-Holding the steel object at that temperature for a definite period of time depending upon its thickness or diameter so that it becomes completely austenitic and then.

-Cooling very slowly the steel object through the transformation range preferably in the furnace upto room temperature. The purpose of full annealing is to reduce hardness, to refine grain size, to make material homogeneous.

2) **Isothermal Annealing :-** In this process transformation occurs at constant temperature. Steel is heated up to austenitic range then fast cooled to a constant temperature below AC1, and held at this temperature for sufficient period for the completion of transformation and then cooled to room temperature in air.
It reduces the annealing time as compared to full annealing.
Because of equalization of temperature, transformation occurs at the same time throughout the cross-section. This leads to more homogeneity in structure.

3) **Spheroidise Annealing :-** This heat treatment is given to high carbon and air hardening alloy steels to soften them and to increase machinability. Following methods produce spheroidised structures.
   i) **Hardening and high temperature tempering: -** Due to tempering of hardened steels at 650ºC - 700 ºC for a long time, cementite globules are formed in the matrix of ferrite.
   ii) **Holding at just below AC1 :-** Due to holding for a long time at just below the lower critical temperature, cementite from pearlite globularises. The process is very slow.
   iii) **Thermal cycling around AC1 :-** Due to thermal cycling in a narrow temperature interval around AC 1, cementite lamellae from pearlite becomes spheroidal. During heating

		above A1, Cementite or carbides try to dissolve and during cooling they try to form. This repeated action spherodises the carbide particles. 4) **Process annealing :-** Process annealing is usually subcritical annealing and is applied to remove the effects of cold work, to soften and permit further cold work as in sheet and wire industries. Ferrous alloys are heated to a temperature close to but below the lower limit of the transformation range (550ºC to 650 ºC) are held at that temperature and then cooled usually in air in order to soften the alloy for further cold working as in wire drawing. 5) **Bright annealing :-** Annealing of steel components is carried out using some protective medium to prevent oxidation and surface discoloration. Such type of annealing keeps the surface bright and hence is called bright annealing. The surface protection is obtained by the use of an inert gas such as argon or nitrogen or by using reducing atmospheres. 6) **Box annealing: -** Here annealing is carried out in a sealed container under conditions that minimize oxidation. The components are packed with cast Iron chips, charcoal or clean sand and annealed in a way similar to full annealing **(Any two methods from above. Figures are not essential but if drawn it would be considered.)**	
	b)	**Explain the procedure in normalizing.** Normalising is similar to annealing. The process consist of heating to above the upper critical temperature AC3 for hypoeutectoid steels and above Acm for hypereutectoid steel by 30 to 50ºC, holding long enough at this temperature for homogeneous austenization and cooling to room temperature in still air. Due to air cooling which is slightly fast as compared to furnace cooling employed in full annealing, normalized components show slightly different structure and properties than annealed components. Hypereutectoid steels are usually normalized from above Acm temperature. Normalising produces microstructures consisting of ferrite and pearlite for hypoeutectoid steels. For eutectoid steels, the microstructure is only pearlite and it is pearlite and cementite for	Suitable description 04 Marks

		hypereutectoid steels.	
	c)	**Describe Nitriding process.** Nitriding accompanies the introduction of nitrogen into the surface of certain types of steel (e.g. containing A1 and Cr) by heating it and holding it at a suitable temperature in contact with partially dissociated ammonia or other suitable medium. This process produces a hard case without quenching or any further heat treatment. Nitriding is accomplished by heating the steel in contact with a source of atomic nitrogen at a temperature of about 550 ºC. The atomic nitrogen diffuses into the steel and combines with iron and certain alloying elements present in the steel and forms respective nitrides. These nitrides increase the hardness and wear resistance of steels. The atomic nitrogen source can be a molten salt bath containing NacN. In gas nitriding, the components are placed in a heat resistant metal container which is then filled with ammonia. When it is completely purged, it is sealed, placed in a furnace and raised to a temperature of approximately 500 ºC .At this temperature the ammonia dissociates. NH3 gives 3H + N and N is absorbed in the surface layer of steel. Parts are maintained at 500 ºC for between 40 to 100 Hours depending upon the depth of case required, after which parts are allowed to cool in the container.	Suitable description .04 Marks
	d)	**Write the advantages and disadvantages of Induction hardening.** **Advantages :-** 1) Fast heating and no holding time leads to increase in production rates. 2) It can be applied to both external and internal surfaces. 3) No scaling and decarburization. 4) Less distortion because of heating of only surface. 5) Through proper design of the heating coils, the shape of the hardened portion can be controlled very closely. 6) Depth of hardening can be controlled by selecting current of appropriate frequency.	Any four advantages 2 Marks.

		7) This process is automatic so it can be carried out with unskilled labour.	
		Disadvantages :- 1) Irregular shaped parts are not suitable for Induction hardening. 2) Cost of equipment is high. 3) Steels having less than 0.4 % carbon cannot be induction hardened. 4) It is beneficial in mass production only. 5) Associates high maintenance cost.	Any four disadvantages 02 Marks
	e)	**Define and explain the carburizing. State its applications.** **Def^{n} :-** The method of increasing the carbon on the surface of a steel is called carburizing OR Carburising is a method of introducing, carbon into solid iron base alloys such as low carbon steels in order to produce a hard case (surface). **Explanation :-** Carburising increases the carbon content of the steel surface by a process of absorption and diffusion. It consists of heating the steel in the austenitic region in contact with a carburizing medium, holding at this temperature for a sufficient period and cooling to room temperature. In the austenitic region, the solubility of carbon is more and hence the carbon from medium diffuses into the steel i.e. in the austenite. High carbon content on surface does not mean high hardness of the surface, unless the carbon is present in the martensitic form. Hence after carburizing hardening treatment is necessary to bring the carbon is the martensitic form. Depending on the medium used for carburizing it is classified as i) solid carburizing ii) Gas carburizing iii) liquid carburizing. **Application :-** Gears, Camshaft, bearings, crank shafts in these components hard and wear surface is required and tough core to withstand impact loads	01 Marks Suitable description 02 Marks 01 Marks
	f)	**Describe case hardening.** Numerous industrial applications such as cams, gears, etc. require a hard wear resistant surface called the case and a relatively soft, tough and shock	

		resistant inside called the core. No plain carbon steel can possess both these requirements at the same time, because a low carbon steel, containing about 0.1 % carbon will be tough, while a high carbon steel of 0.9 % or more carbon will possess adequate hardness when suitable heat treated. However both these requirements may be met by employing a low carbon steel with suitable core properties and then adding (or penetrating) carbon, Nitrogen or both to the surface of the steel part in order to provide a hardened case (or layer) of a definite depth. These treatments are known as case hardening. The processes used to create hardened cases are i) **Carburizing :-** Increasing the carbon on the surface of a low carbon (o.1 – 0.2 % C) and subsequently heat treating the component in a specific manner to produce hard and wear resistant surface and tough center. ii) **Nitriding:** - Introducing nitrogen in the surface of a tough steel so as to produce hard nitrided case with no subsequent heat treatment. iii) **Carbonitriding :-** Introducing carbon and nitrogen in the surface of a tough steel and produce hard and wear resistant case. iv) Flame Hardening. v) Induction hardening.	Suitable description 04 Marks

Q.No.5 a. Following are different types of corrosion

- Dry Corrossion
- Wet Corrossion
- Galvanic Corrossion
- Stay Current Corrossion
- Uniform corrosion
- Pitting Corrosion
- Stress Corrossion (Stress Corrosion Cracking)

Any Four types ---------- 02 Marks

Wet Corrosion: Wet corrosion occurs when a metal or an alloy comes in contact with an aqueous solution of salt, acid or alkali by an electrochemical type of reaction. When a metal is immersed in an aqueous solution, it passes into it in the form of ions i.e. Metals = Ions + Electrons. This tendency of metals is called as electrolytic pressure or solution pressure. As a result of which more and more electrons accumulate on the metal surface leading to more negative electric potential. This leads to more tendency of metal to go into solution i.e. more and more corrosion. This ultimately leads to corrosion on outer part of metal.

OR

Galvanic Corrosion: Galvanic corrosion occurs when two dissimilar metals in contact are exposed to an electrolyte or a metal is exposed to two different electrolytes or a metal is exposed to an electrolyte with varying ion concentration. Under such situation, the metal with less potential becomes anodic and gets corroded.The other metal with more potential becomes cathodic and gets protected. Oxidation reaction (i.e. loss of electrons) occurs at anode and reduction reaction (i.e.gain of electrons) occurs at cathode.

OR

Suitable short explanation of any one process ---------- 02 Marks

Q.No.5 b. **Characteristics of ABS**

Acrylonitrile Butadiene Styrene (ABS) is a type of Thermoplastic type of plastic. This is made up of chain molecules. ABS can be moulded and remoulded in any shape.This plastic is comparatively soft and less strong and chemically less inert. The heat resistance is low and cannot be used at higher temperatures.It has Good impact resistance, Rigidity, strength and toughness and moderate heat resistance.

---------- **02 Marks**

Applications of ABS

- Toys
- Refrigerator Lining material
- Lawn and Garden equipments
- Highway Safety devices
- Automobile Parts
- Hoses
- Moulded parts

---------- **02 Marks**

Q.No.5 c. **Acrylics & its properties**

Acrylics or Polymethyl methacrylate is a Thermoplastic type of plastic. It is made of long chain molecules. It softens when gets heated and hardens when gets cooled. These have low melting points. This can be remoulded to any shape. Acrylics has excellent Light transmission power. It also has good resistance to moisture.It also has ease in fabrication. ---------- **02 Marks**

Applications of Acrylics

- Lens
- Drafting Instruments
- Light Covers
- Sign Boards
- Lamp Shades
- Plastic Jwellery

---------- **02 Marks**

Q.No.5 d. Differentiation between Thermoplastics and Thermosetting Plastics

Thermo plastics	**Thermosetting Plastics**
1.Composed of chain molecules	1.Composed of cross linked molecules
2.Can be repeatedly softened by heat and hardened by cooling	2.Can be softened only first time when Heated. But cannot be softened on subsequent cooling
3. Comparatively softer and less strong	3.Stronger and Harder
4.Cannot be used at Higher Temperatures	4.Can be used at Higher Temperatures
5.Produced by additional Polymerization	5.Produced by Condensation and Polymerization.
6.Can be easily Moulded and remoulded into any shape	6. Cannot be moulded and remoulded into new shape.
7. Used for Toys,combs,toilet goods, tapes Hoses,pipes	7.Used for Telephone receivers,cabinets Camera bodies.

Any four correct points --- 04 Marks

Q.No.5 e. Properties and uses of Polyesters

Properties: 1.Moderate strength and toughness

2. Electrical Insulation property

3.Can be used at low and High temperatures

4.Good dimensional Stability

5. Good surface hardness and finish

6.Good impact strength.

---------- **02 Marks**

Uses: 1.Helmets 2.Fibre glass boats 3.Chairs 4.Fans 5. Mats 6.Wire and Cable Insulation ---------- **02 Marks**

Q.No.5 f. **Properties of Fibre Reinforced Materials**

- Good strength
- Good formability
- Light weight
- Good corrosion resistance
- Good Fatigue Resistance
- Moderate Density
- Good toughness
- High stiffness at high temperatures.

---------- **02 Marks**

Applications of Fibre Reinforced Materials

- Boat Hulls
- Car bodies
- Truck cabins
- Aircraft fittings
- Glass Frames
- Automobile Parts

---------- **02 Marks**

Q.No.6. a. **A. IS Specifications for Grey Cast Iron**

1. **FG 200/2.5**
   FG-Ferritic Grey Cast Iron

   200 – Compressive Strength Kgf/mm2

   2.5- Impact Strength

2. **PG 200/2.0**
   PG-Pearlitic Grey Cast Iron

   200 – Compressive Strength Kgf/mm2

   2.0- Impact Strength

---------- **02 Marks**

B. IS Specification for Tool Steel

1. **T 75 W 18 Cr 4 V 1**
   T- Tool Steel

   75 – 0.75 % Carbon

   W 18 – Tungsten 18%

   Cr 4 – Cromium 4%

   V- Vanadium 1%

2. **T 35 Cr 5 Mo 1 V 30**
   T- Tool Steel
   35 – 0.35 % Carbon
   Cr 5 – Cromium 5%
   Mo 1- Molybdenum 1%
   V 30 – Vanadium 0.30%

---------- **02 Marks**

Q.No.6 b. Prevention and control methods of Corrosion

- Proper selection of materials, proper design and fabrication procedure
- Modification of Corrosive environment
- Purification and alloying
- Cathodic Protection
- Application of protective coatings
- Applications of inhibitors

Names of any four methods ---------- **04 Marks**

Q.No.6 c. Engineering Applications Of Powder Metallurgy

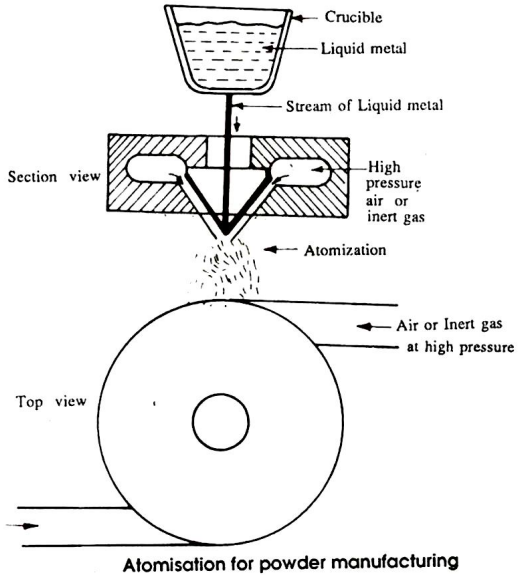
- Manufacturing of Refractory parts like electric bulb coils, fluroscent lamps, valves, mercury arc rectifiers.
- Manufacturing of Carbide tools used for lathes,Milling, Drilling Wire Drawing,Dies.
- Manufacturing of porous self lubricating bearings

- Manufacturing of Automobile industries parts like porous bearings, Oil pump gears, levers,clutch plates, contacts , sprockets.
- Manufacturing of Aerospace parts like bearings, gyroscope parts, heat shields, parts of rockets and missiles.
- Manufacturing of Atomic Energy application parts for atomic reactors, magneto-hydrodynamic generators, turbines, cladding materials.
- Manufacturing of Defence application parts in rockets, missiles, nose piece,fuses,cartridge cases, frangible bullets.
- **Other Applications**: Metal filters used in chemical, pharmaceutical industries, pourous nickel electrodes used in Ni-Cd Batteries, Sintered Friction material used in brakes,Electrical contacts used in Relays, Actuators, timers ,switch gears, Various types of gears,pawls, sintered tungsten carbide balls in ball point pens, Surgical implants.

Any four application areas ------- 04 Marks

Q.No.6 d. **Atomization Method for Powder Making**

Principle of this method consists of disintegration of stream of molten metal into fine particles mechanically by using a jet of compressed air ,inert gases or water as shown in figure below.This method has many advantages and widely used in practice.



Atomisation for powder manufacturing

This method is used for making powder of various metals such as tin, lead, zinc, aluminium which have low melting points. Powder particles are sphere shaped. By varying temperature of metal, pressure and temperature of atomizing gas, rate of flow of metal through orifice,the particle size and shape is decided. It is a flexible method. This method is not suitable for refractory metals.

OR

Any other method like Milling,Shotting, Graining, Condensation,Thermal decomposition,Reduction, Electrodeposition, Hydrometallurgical reduction with proper description and figure (if required)

------- 04 Marks

Q.No.6 e. **Magnaflux Test**

Magnaflux test is a Non Destructive Testing method used to detect various kinds of flaws or defects in ferromagnetic components such as weldings,castings,forgings,of iron and steels.The component to be inspected is magnetized as shown in figure and inspection medium is applied on the component. Or magnetization of component and application of inspection medium can be done simultaneously.

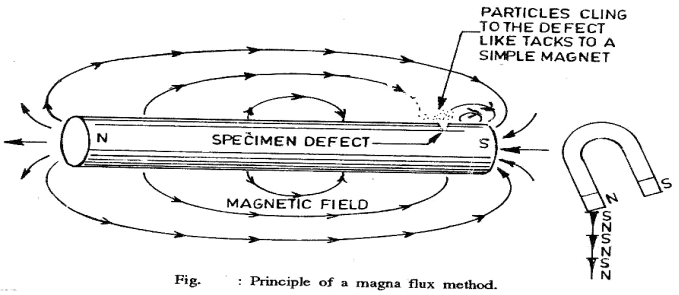


Fig. : Principle of a magna flux method.

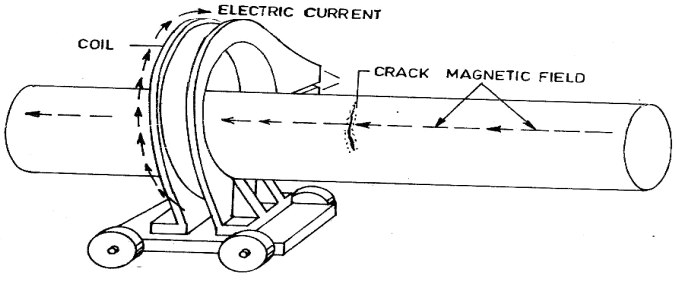


Fig. : Longitudinal method of magnetization.

In the dry method of inspection, a special powder of ferromagnetic nature is applied on surface by hand shaker, vibrating screen, or any other method so that powder gets spread uniformly on the surface of component. In wet method of inspection, a liquid containing ferromagnetic particles suspended in some carrier such as kerosene or petroleum oil is applied by dipping, spraying or brushing method. Magnetization of component is done by external magnetic yoke coil or by passing current through it. A magnetic pole is formed at crack or flaw ,which causes the magnetic powder to concentrate on this area and flaw gets detected.The detection of sub surface flaw or defect depends upon strength of magnetic field, distance from surface at which the defect is located and width of defect.

Proper Figure with description and principle ---------- 04 Marks

Q.No.6 f. Differentiation between Destructive and Non destructive Testing

Destructive Testing	**Non destructive Testing**
1. Involves destruction of test metal or Component	1. Does not require destruction of test metal or component
2. Determines mainly strengths, Hardness Endurance,creep levels and Mech properties	2. Used to detect surface and sub surface defects in metal or parts.
3. Involves more time	3. Requires less time
4. Generally done before design of parts	4. Used as a quality control check method
5. Gives idea about strengths and loads a part can sustain in service	5. Gives an idea about possible defects in part and possibility of failure in service.

Any four relevant points -------- 04 Marks