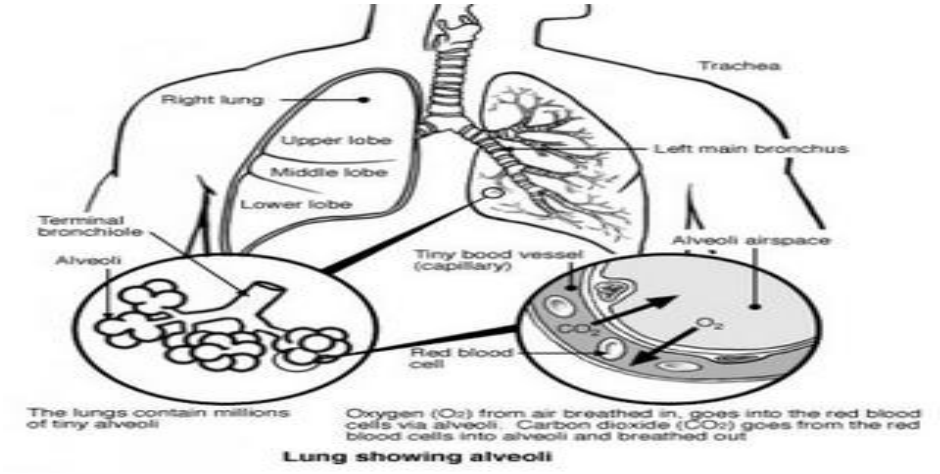
WINTER– 2017 EXAMINATION

Model Answer **Subject Code:** 17543

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.

Q. No.	Sub Q. N.	Answer	Marking Scheme
1.	(A)	**Attempt any THREE**	12
	(a)	**Define biomaterial and classify ceramic biomaterial.** **Ans:** **Definition of biomaterials:** A biomaterial is defined as any systemically, pharmacologically inert substance or combination of substances utilized for implantation within or incorporation with a living system to supplement or replace functions of living tissues or organs. In order to achieve that purpose, a biomaterial must be in contact with living tissues or body fluids resulting in an interface between living and non-living substances. **OR** It replaces a part or function of the body in safe reliable, economic and physiologically acceptable manner. **Classification of Ceramic biomaterial:** 1. Carbon 2. Alumina 3. Zirconia 4. Resorbable Ceramics.	**02** **02**
	(b)	**Give the four properties of Zirconia.** **Ans:** **Properties of Zirconia: (Any four)** 1. Use temperatures up to 2400°C 2. High density 3. Low thermal conductivity (20% that of alumina). 4. Chemical inertness. 5. Resistance to molten metal's. 6. Ionic electrical conduction. 7. Wear resistance. 8. High fracture toughness. 9. High hardness. 10. High refractive index. 11. Excellent biocompatibility and wear properties. 12. Fine grain size, lack of surface roughness.	**04**
	(c)	**Draw labelled structure of Lungs.** **Ans:**  **Fig: Structure of Lungs**	**04**

	(d)	**Give the composition of Teeth.** **Ans:**	**04**

Constituents[a]	*Dentine*	*Enamel*
Ca^{2+}	27.0	36.0
PO_4^{3-} as P	13.0	17.7
Na^+	0.3	0.5
K^+	0.05	0.08
Mg^{2+}	1.1	0.44
CO_3^{2-}	4.5	2.3
F^-	0.05	0.01
Cl^-	0.01	0.30
$P_2O_7^{4-}$	0.08	0.022
Ash[b]	70	97.0
Organic	20	1.0
H_2O[c]	10	1.55

Table: Composition of Teeth

	(B)	**Attempt any <u>ONE</u>**	**06**
	(a)	**List materials used for deep cavities and state the use of collagen in dentistry.** **Ans:** **Materials used for deep cavities:** 1. Plastic (Cements, pastes) or solid pieces (Thin Cones) 2. Many of these cements contain synthetic polymers such as polyethylene, epoxy, Polyacrylate, Polycarbonate, Silicones which contribute to the hardness of final product and also seal the internal part of the canals. 3. Gutta -percha mixed with cement is widely used as sealing materials.	**03**

Material	*Observation*
Collagen	Collagen sponges decreased seepage of blood during periodontal mucoginvival surgery
Collagen	Collagen membranes have capacity to support regeneration of periodontal tissues
Collagen gel-allogeneic bone	Collagen gel-allogeneic bone implant encouraged ingrowth of regenerative tissue and new bone
Collagen tricalcium phosphate	Collagen-tricalcium phosphate grafts resulted in less soft tissue recession
Collagen coated root implants	Long lasting retention of collagen coated acrylic root implants
Collagen solution	Collagen solution applied to root surface suppressed epithelial migration and new tissue formation
Collagen graft	Collagen graft promoted formation of normal mucous membrane
Collagen allogenic bone	Bone collagen grafts reduced probing depths and gained new attachment
Collagen solution	Application of collagen solution to root surface suppressed epithelial migration and promoted new cementum formation
Collagen film + tetracycline	Topical administration of tetracycline on a collagen film remains active for two to three weeks

Table: Use of collagen in dentistry

03

	(b)	**Explain cellular events in bone healing process.** **Ans: Cellular events in bone healing process** 1. Fibroblastic 2. Chondroblastic.	

3. Osteoblastic a) Trobacular bone b) Compact bone.

Fibroblastic: is a type of cell that synthesizes the extracellular matrix and collagen, the structural team work for animal tissue and plays a critical role in the bone healing .Fibroblast are the most common cells of connective tissue in animals. Fibroblast from the periosteum and surrounding tissues produce cells energetically in to the region of fracture 1 or 2 days.

Chondroblastic: Next, a soft callus made mostly of collagen is created around the fracture by another special group of cells called chondroblasts. This stage can last anywhere from 4 days to 3 weeks. **06**

Osteoblastic: Osteoblasts begin to form new trabecular bone in the marrow. After two weeks a collagen matrix replaces the entire clot and chondroblasts are seen in the region between the matrix and advancing bone growth. After a week or two the uptake of calcium and phosphorous in to the wound area increases which is attributed to the increased rate of bone mined deposition. By third and fourth weeks the major activity is the replacement of chondroblasts by trabecular bone and after 5 -6 weeks the major activity is the remolding of the bone tabular with the deposition of compact bone.

2. Attempt any FOUR **16**

(a) Write any four historical developments of biomaterial.

Ans: (Any four) **04**

Year	Author	Activity
600BC	Sushruta Samhita	Nose Reconstruction
1860 -1870	J. Lister	Aseptic surgical techniques Developed.
1893 - 1912	W. A. Lane	Steel screws and plates for fracture fixation.
1912	W. D. Sherman	Vanadium steel plate, first alloy developed exclusively for medical use, less stress concentration and corrosion.
1926	E.W. Hey-Groves	Used carpenter's screw for femoral neck fracture fixation.
1931	M. N. Smith-Petersen	Designed first femoral neck fracture fixation nail made originally from stainless steel, later changed to vitallium.
1938	P. Wiles	First total hip replacement.
1940	M. J. Dorzee , Franceschetti	Acrylics for corneal replacement.
1944	W. J. Kolff	Hemodialyser.
1946	J. Judet and R. Judet	First biomechanically designed hip prosthesis. First plastics used in joint replacement.
1952	A. B. Voorhees, A. Jaretzta, A.H. Blackmore	First blood vessel replacement made of cloth.
1953	A. Kantrowitz	Intraortic balloon pumping.
1958	J. Charnley	First use of acrylic bone cement in total hip replacements.
1958	S. Furman , G. Robinson	First successful direct stimulation of

		heart.
1960	A. Starr, M. I. Edwards	Heart valve.
1980	W. J. Kolff	Artificial heart.

Table: Historical developments of biomaterial

(b) Describe the stress-strain curve for ductile material. — **04**

Ans: Description of the stress-strain curve

The x-axis represent strain and y-axis represent stress. The stress is force per unit cross-sectional area and strain is change in length per original length. The ability of material to withstand static load can be determined by a standard tensile, compressive and shear tests. From a load-displacement curve a stress-strain diagram can be constructed by knowing cross-sectional area and length of rod. The stress-strain curve of a solid can be demarcated by the yield point or stress (YS) into elastic and plastic regions. In the elastic region, the strain increases in direct proportion to the applied stress whereas in the plastic region strain changes are no longer proportional to the applied stress. Further when the applied stress is removed, the material will not return to its original shape but will be permanently deformed. This phenomenon is termed as plastic deformation. The peak stress in fig. is often followed by an apparent decrease until a point is reached where the material ruptures.

The peak stress is called as the tensile or ultimate tensile strength (TS or UTS) and the final stress where failure occurs is called the failure or fracture strength (FS). Hardness is the measure of plastic deformation and is defined as the force per unit area of indention or penetration and thus has the dimension of stress. A material that can withstand high stresses and will undergo considerable plastic deformation (ductile-tough material) is tougher than the one that has high capacity for deformation but can only withstand relatively low stress(ductile soft).

(c) List the four applications and two properties of Alumina.

Ans:

Applications of Alumina (Any four) — **02**

1. The implant devices are prepared from purified alumina.
2. High density alumina is used in load bearing hip prostheses.
3. Dental implant.
4. Orthopedic uses of alumina consist of hip & knee joints, tibial plates, femur shaft, shoulders, radius, vertebra, leg lengthening spacer & ankle joint prosthesis.
5. Reconstructive maxillofacial surgery to cover bone defects.
6. Porous alumina is also used in teeth roots.

Properties of Alumina (Any two) — **02**

1. Chemically stable and excellent corrosion resistant.
2. It is insoluble in water & slightly soluble in strong alkali and acid.
3. High melting point.
4. Highest hardness.
5. Highest mechanical strength
6. Good biocompatibility.
7. High wear resistance & reasonable strength.

(d) State two properties and four applications of carbon. — **02**

Ans:

Properties of Carbon: (Any two)

1. The carbons are inert ceramic materials.
2. In the quasi-crystalline forms, the degree of perfection of the crystalline structure and the morphological arrangements of the crystallites and pores are important in determining the properties of carbons.

3. All the carbons, currently of interest for use in medical devices have the quasi - crystalline turbostatic structure.
4. Carbon has good biocompatibility with bone and other tissues.
5. It also has high strength and an elastic modulus close to that of bone and so do not suffer from fatigue.

OR

Property	*Graphite*	*Glassy*	*Pyrolytic*
Density (g/ml)	1.5-1.9	1.5	1.5–2.0
Elastic modulus (GPa)	24	24	28
Compressive strength (MPa)	138	172	517 (575[a])

Table: Mechanical properties of carbon

Applications of Carbon: (Any four)

1. Carbon coatings find wide applications in heart valves, blood vessel grafts, percutaneous devices because of exceptional compatibility with soft tissues and blood.
2. Percutaneous carbon devices containing high-density electrical connectors have been used for the chronic stimulation of the cochlea for artificial hearing and stimulation of the visual cortex to aid the blind.
3. LTI carbon deposited on preformed graphite substrates or metal implant is used in restorative dentistry.
4. The ability of carbons to absorb proteins without alteration is thought to be an important factor contributing to the blood compatibility of carbon surfaces. This causes reduction in critical surface tension and blood adhesion.
5. Platelet adhesion and activation is found to be least with carbon coated surfaces. Hence ULTI coated valves are most widely used.

02

(e) Explain the need of cardiac pacemaker.

Ans:

The rhythmic beating of the heart is due to triggering pulses that originate in an area of specialized tissue in the right atrium of the heart. This area known as the Sino-arterial node. In abnormal situation, if this natural pacemaker cases to function or becomes unreliable or if the triggering pulse does not reach heart muscle because of blocking by damaged tissues, the natural and normal synchronization of the heart action gets disturbed. When monitored, this manifests itself through a decrease in the heart rate and changes in the ECG waveform. By giving external electrical stimulation impulses to the heart muscle, it is possible to regulate the heart rate. These impulses are given by an electronic instrument called a pacemaker.

04

(f) Draw any two self-tapping dental implants.

Ans: (Any two)

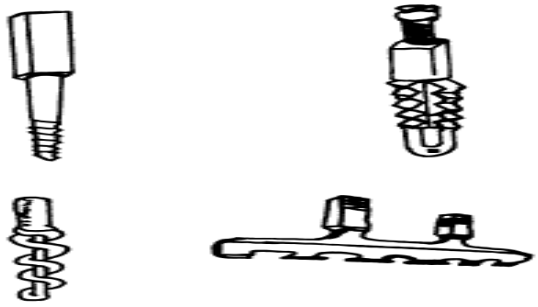
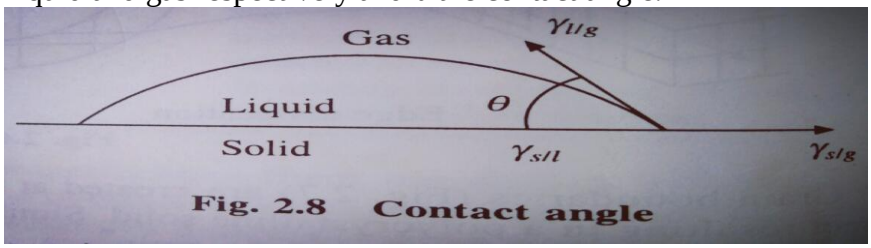


Fig: Self-tapping dental implants

04

3.		**Attempt any <u>FOUR :</u>**	**16**
	(a)	**Explain the contact angle method.** **Ans :** When a liquid drop is placed onto a solid surface or another liquid surface two things may happen. The liquid may sit on the surface in the form of a droplet or it may spread out over the entire surface. Which event occurs depend on the interfacial free energies of the two substances. At equilibrium contact angle or Young-Dupree equation describes **$\gamma s/g = \gamma s/l + \gamma l/g \cos \theta$** where **$\gamma s/g$, $\gamma s/l$** and **$\gamma l/g$** are the interfacial free energy between the solid and gas; solid and liquid, liquid and gas respectively and **θ** the contact angle.  **Fig: Contact angle between the liquid and solid surface**	**04**
	(b)	**Give the meaning of thermal treatments and sterilization.** **Ans :** **Thermal Treatments:** Process in which a metal is heated to a certain temperature and the cooled in a particular manner to alter its internal structure for obtaining desired degree of physical and mechanical properties such as brittleness, hardness, and softness. **Sterilization:-**Sterilization is a term referring to any process that eliminates or kill all forms of life, including transmissible agents such as fungus, bacteria, viruses, spare forms etc.present on a surface.	**02** **02**
	(c)	**Give four application of collagen.** **Ans :** 1. Collagen is used for prevention of oral bleeding. 2. It is used to support of regeneration of periodontal tissues. 3. It is used for promotion of healing of mucosal lining. 4. It is also used for prevention of migration of epithelial cells. 5. Collagen has also been used as a carrier substance for immobilization of various active substances used in dentistry. 6. Dressing materials containing collagen have been employed effectively to promote of defects in oral mucous membrane. **OR**	**04**

Material	*Observation*
Collagen	Collagen sponges decreased seepage of blood during periodontal mucoginvival surgery
Collagen	Collagen membranes have capacity to support regeneration of periodontal tissues
Collagen gel-allogeneic bone	Collagen gel-allogeneic bone implant encouraged ingrowth of regenerative tissue and new bone
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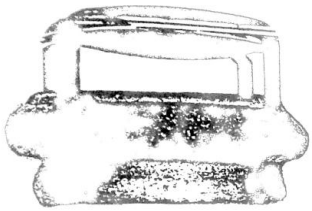
Collagen film + tetracycline	Topical administration of tetracycline on a collagen film remains active for two to three weeks

Table: Use of collagen in dentistry

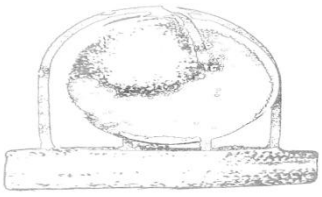
(d) **List prosthetic heart valves and draw any two.** **04**

Ans : (List-02 Mark, Diagram-02 Mark)

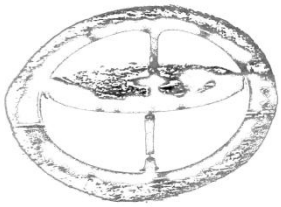
1. Disk –in-cage prosthetic heart valve.

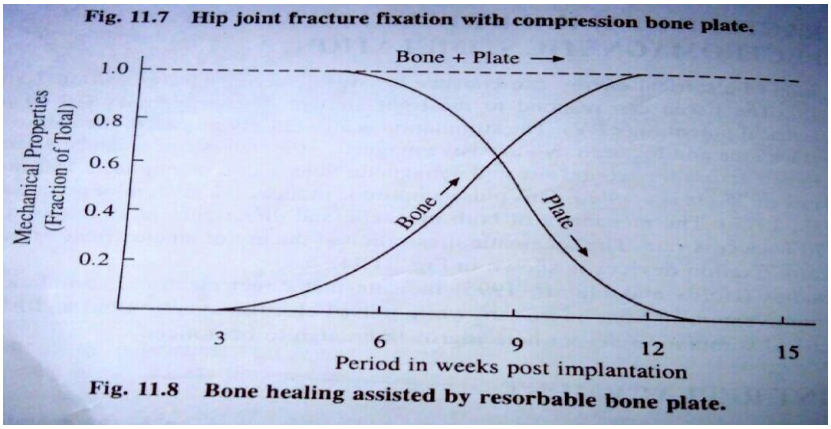


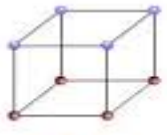
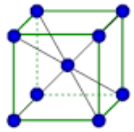
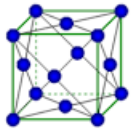
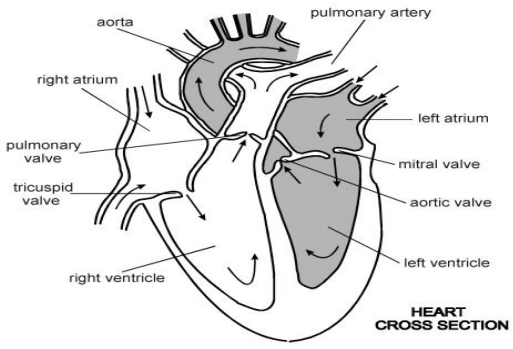
2. Ball-in-cage prosthetic heart valve.



3. Tilting disk.



		4. Porcine aortic valve. 	
	(e)	**Explain bone regeneration with resorbable material.** **Ans :**  **Fig: Bone healing assisted by resorbable bone plate** The purpose of temporary fixation device is to stabilize fractured bone until natural healing processes restored sufficient strength so that the implant can be removed. These devices include pins, nail, wires, screws, plates and intramedullary devices. Bone plates are used for joining bone fragments together during healing of load bearing bones. The plate provides rigidity for fixation of the fracture. Screws are used with the plates to secure them to the bone. There are different types and sizes of fracture plates. The force generated by the muscles in the limbs are very large ,femoral and tibial plates must be very strong. One major drawback of the healing by rigid plate fixation is the weakening of the underlying bone such that refracture may occur following removal of the plate. This is largely due to the stress shield effect. Therefore new material are being evaluated for fabrication of plates with a low axial stiffness and moderate bending and torsional stiffness to facilitate fracture healing without bone atrophy. Another approach is to use a resorbable material for bone plate. As the strength of the fracture site increases due to healing processes, the resorption of the implant begins to take place. The gradual reduction of strength of implant transfers an increasingly larger percent of the load to the healing bone .The degration products of such plates must be biocompatible .the design aspect must involve producing the appropriate combination of initial strength and time dependent performance through the variation in absorption rate and microstructure. There is no need for second operation in removing these plates.	**04**

4.	**(A)**	**Attempt any <u>THREE</u>**	**12**
	(a)	**Explain the crystal structure of solids.** **Ans :** There are three basic crystal structures. 1. Simple cubic has an atom located at each corner.  2. Body centered cubic has an additional atom at the Centre of cubic.  Cubic body centered (bcc) 3. Face centered cubic has an additional atoms on each centre of face plane.  Cubic face centered (fcc)	**04**
	(b)	**Give four applications of acrylic polymer.** **Ans :** **Applications of acrylic polymers :** 1. It is used extensively in medico-surgical application as contact lenses. 2. Implantable ocular lenses. 3. Bone cement for joint fixation. 4. Dentures and maxillofacial prostheses. 5. It is used for treatment for coxarthropathy & in hip arthroplasties. 6. It is suitable for the repairs of cranial defects.	**04**
	(c)	**Describe the structure of Heart.** **Ans :**  **Fig: Structure of heart**	

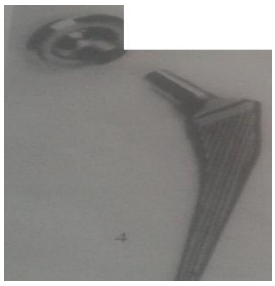
		The heart is a specialised muscle that contracts regularly and continuously, pumping blood to the body and the lungs. The pumping action is caused by a flow of electricity through the heart that repeats itself in a cycle. If this electrical activity is disrupted - for example by a disturbance in the heart's rhythm known as an 'arrhythmia'- it can affect the heart's ability to pump properly. The heart has four chambers - two at the top (the atria) and two at the bottom (the ventricles). The normal trigger for the heart to contract arises from the heart's natural pacemaker, the SA node, which is in the top chamber (see the diagram, right). The SA node sends out regular electrical impulses causing the atrium to contract and to pump blood into the bottom chamber (the ventricle). The electrical impulse then passes to the ventricles through a form of 'junction box' called the AV node (atrio-ventricular node). This electrical impulse spreads into the ventricles, causing the muscle to contract and to pump blood to the lungs and the body.	**04**
	(d)	**List any four mechanical properties of bone.** **Ans :** *Direction of test* / *Modulus of elasticity (Gpa)* / *Tensile strength (Mpa)* / *Compressive strength (Mpa)* Leg bones — Longitudinal Femur — 17.2 — 121 — 167 Tibia — 18.1 — 140 — 159 Fibula — 18.6 — 146 — 123 Arm bones — Longitudinal Humerus — 17.2 — 130 — 132 Radius — 18.6 — 149 — 114 Ulna — 18.0 — 148 — 117 Vertebrae — Longitudinal Cervical — 0.23 — 3.1 — 10 Lumbar — 0.16 — 3.7 — 5 Spongy bone — 0.09 — 1.2 — 1.9 Skull — Tangential — – — – — – Radial — — — 97 **Table: Mechanical properties of bone**	**04**
	(B)	**Attempt any <u>ONE.</u>**	**06**
	(a)	**Write properties of enamel and dentine and list materials used for filling and restoration.** **Ans :** Enamel and dentine forms the major part of the teeth. Mechanical properties of enamel and dentin are : *Density (g/cm^3)* / *Compressive Strength (MPa)* / *Young's Modulus (GPa)* / *Thermal conductivity (W/mk)* Enamel — 2.2 — 241 — 48 — 0.82 Dentin — 1.9 — 138 — 13.5 — 0.59 **Fig: Mechanical properties of teeth**	**02**

		Dental filling material : 1) Gold foil. 2) Platinum 3) Aluminum: 4) Tin and iron. 5) Lead and tungsten. **Dental restoration material:** 1) Amalgam: is a metallic filling material composed from a mixture of mercury (from 43% to 54%) and powdered alloy made mostly of silver, tin, zinc and copper, commonly called the amalgam alloy. 2) composite resin : (also called white fillings) 3) Glass Ionomer Cement. 4) Resin modified Glass-Ionomer Cement (RMGIC)	**02** **02**
	(b)	**Explain total hip replacement and draw any two total hip replacement devices.** **Ans :** **Explanation :** A hip replacement consists of femoral component that is a ball mounted on a shaft & an acetabular component having a socket into which ball is placed. Cobalt - Chromium & Titanium-Aluminum-Vanadium alloys or alpha alumina are used by different manufacturer for the femoral component & high molecular weight polyethylene to cover the socket. Several design types with different stem lengths are available. Boutin (1974) had reported several hundred successful clinical cases using a ceramic ball on a metallic stem femoral component & a matching alumina acetabular component. Boutins devices were all fixed in the bony tissues with standard PMMA cement. Subsequently the HDHMW polyethylene cups were introduced along with ceramic balls attached to metallic stem.The number of alternative combinations of materials use in total hip replacement include Metal- Metal, Metal- HDHMW polyethylene, Ceramic- HDHMW polyethylene, Ceramic- Ceramic. **Types of total hip replacement devices. (any 2)** 1. Thompson, 316L. 	**02** **02 marks each**

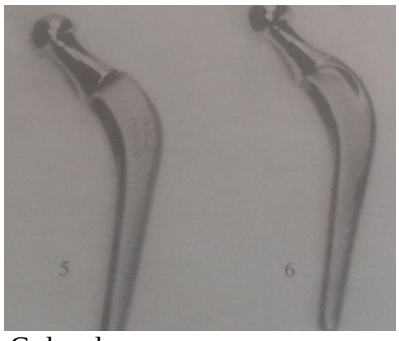
2. Austin Moore, 316L.

3. Bipolar, 316L.

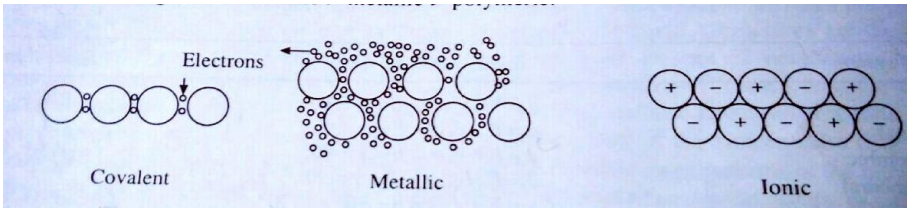
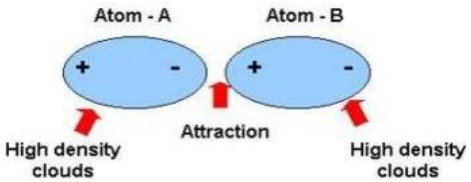
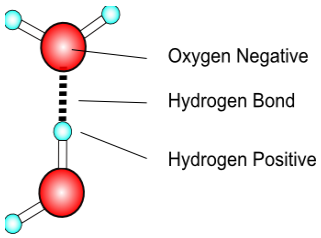
4. Modular bipolar, Ti alloy, Co-Cr head.



5. Charnley Co-Cr.



6. Modular, Ti alloy Stem, Co-Cr head.

5.		**Attempt any <u>FOUR</u>**	**16**
	(a)	**List molecular bonds and sketch any two.** **Ans:-(List -02 Marks , Sketch-02 Marks)** **i)** Metallic bonds **ii)** Covalent bonds **iii)** Van der waals **iv)** Hydrogen **v)** Ionic   Van der Waals Bond  	**04**
	(b)	**State composition of stainless steel and give its two applications.** **Ans:-** **Composition of stainless steel:** Table 3.2 Composition of austenitic stainless steels (balance % iron)* *AISI* | *%C* | *%Cr* | *%Ni* | *%Mn* | *% other elements* 301 | 0.15 | 16-18 | 6-8 | 2.0 | 1.0 Si 304 | 0.07 | 17-19 | 8-11 | 2.0 | 1-Si 316, 18–8sMo | 0.07 | 16-18 | 10-14 | 2.0 | 2-3 Mo, 1.0 Si 316L | 0.03 | 16-18 | 10-14 | 2.0 | 2-3 Mo, 0.75 Si, 430 F | 0.08 | 16-18 | 1.0-1.5 | 1.5 | 1.0 Si, 0-6 Mo **Applications of stainless steel :** 1. Stainless steel ate basically used in orthopedic implants, the major uses include fracture fixation and joint replacement	**02** **02**

		2. They are used in replacement of hip joints, ankle joints, knee joints, leg lengthening spacers, intramedullary pins, femur shafts, bone plate etc. 3. The uses of these alloys for fabrication of mandibular staple bone plates, heart valves and many devices with neurosurgical application have been investigated.	
	(c)	**Give four properties of Titanium based alloy.** **Ans:** 1. Titanium alloy is a light metal. 2. Density 4.505 g/cm cube at 25 Degree Celsius. 3. Melting point of titanium is about 1665 Degree Celsius. 4. Commercially alloyed titanium grades can range from a tensile strength as low as 600 MPa (such as Ti-3A1-2.5V) to a tensile strength as high as 1250 MPa. 5. They have extraordinary corrosion resistance and the ability to withstand extreme temperatures.	**04**
	(d)	**Write meaning of temporary fixation devices using two examples.** **Ans:** Temporary fixation of joints can be achieves by implementing temporary fixation devices.The purpose of temporary fixation devices is to stabilize fractured bone until natural healing processes have restored sufficient strength so that the implant can be removed. **Examples:** These devices include pins, nails, wires, screws, plates, and intramedullary devices. 1. Bone plates are used for joining bone fragments together during healing of load-bearing bones. The plate provides rigidity for the fixation of the fracture. 2. Screws are used with the plates to secure them to the bone.	**02** **02**
	(e)	**Explain process of metallic corrosion.** **Ans:** Metallic implants fail due to corrosion, releasing significant concentration of corrosion product into solution. Reactions of metals with aqueous environments are electrochemical in nature involving the movement of electron to the cathode. For implanted metals in aqueous environment with dissolved oxygen the primary anodic and cathodic reactions are represented by equations (1) and (2) respectively. $M \rightarrow M^{n+} + ne^-$ (1) $\frac{1}{2} O_2 + H_2O + 2e^- \rightarrow 2OH^-$ (2) These primary corrosion products react with tissue fluids, dissolved gases, inorganic and organic ions. The cervices between components ,wounds etc, can have extremely low oxygen concentration leading to cathodiac reaction of water as given in equation (3) $2H_2O + 2e^- \rightarrow H_2 + 2OH^-$ (3) Thus most corrosion in metals occurs through the oxidation process at anode. The metals with the positive potential are the noble metals which are least reactive (cathodiac).The corrosion rate is directly related to the current flow between the anode and cathode. The variation in the oxygen concentration over the surface in the environment can induce electrochemical cell. The sites with low oxygen concentration become anodes and corrosion takes place.	**04**

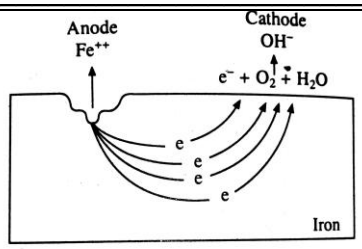


Fig. 3.3 Schematic illustration of electrochemical cell set up between anodic and cathodic sites on an iron surface undergoing corrosion.

C

(f) Give four materials used for joint replacement. — **04**

Ans:

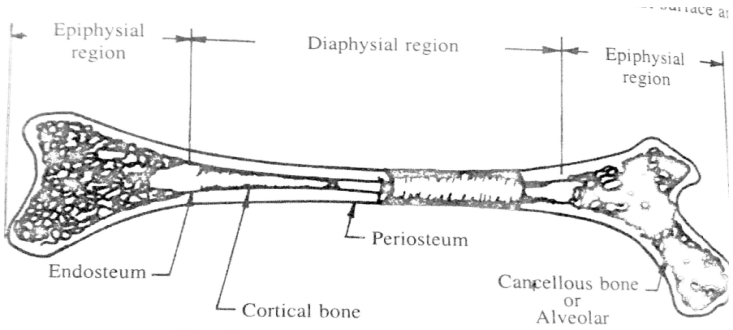
The following biomaterials used in total joint replacement : — **01 mark each**

Material
Metals
Stainless steels 316L
Cobalt-based alloys
Cast Co–Cr–Mo
Wrought Co–Ni–Cr–MO
Wrought Co–Cr–W–Ni
Titanium-based materials
CP Ti
Ti–6Al–4V
Ti–5Al–2.5Fe
Ti–Al–Nb
Ceramics
Bioinert
Carbon
Alumina
Zirconia
Bioactive
Calcium phosphates
Bioglasses
Polymers
PMMA
UHMWPE/HDPE
Polysulfolene
PTFE
Composites
Polymer-based
Polysulflone-carbon
Polycarbonate-carbon
Polysulfone-Kevlar
Polycarbonate-Kevlar

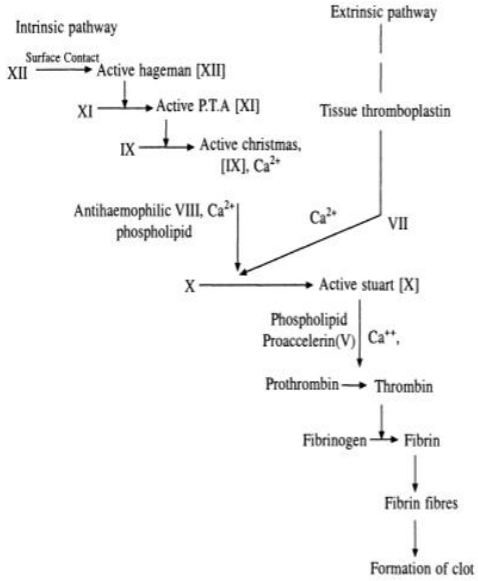
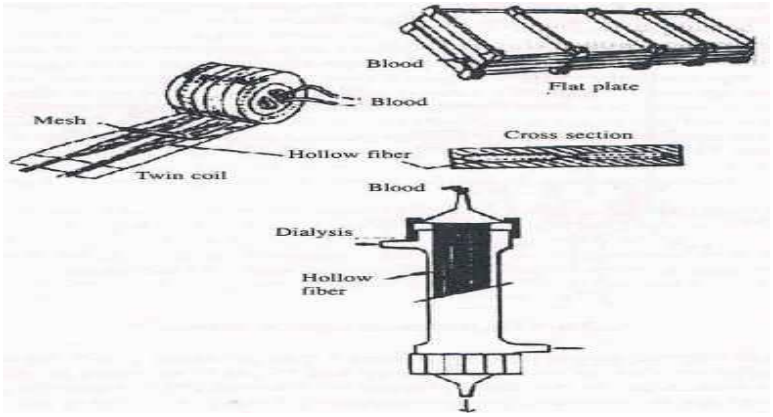
6. Attempt any <u>FOUR :</u> — **16**

(a) Sketch labeled structure of typical bone. — **04**

Ans:



	(b)	**State the importance of eye shield.** **Ans:** These are used in the treatment of basement membrane associated diseases, corneal abrasion and erosion, epithelial defects, cataract extraction, penetrating keratroplasty and other diseases that cause eye inflammation.	**04**
	(c)	**Give four materials and two applications of contact lenses.** **Ans:** **(Any four materials of the following)** The materials used for construction of contact lenses can be classified as **rigid, elastomeric and hydro gel.** **- Rigid lenses** can be subdivided into non oxygen-permeable polymethyl methacrylate lenses and oxygen permeable lenses which include five types; cellulose acetatelbutyrate, siloxanyl alkyl methacrylate, silicone resin, alkyl styrene and fluorocarbon polymers. Of the oxygen-permeable rigid contact lens materials, the lenses with the widest distribution are those made of siloxanyl- alkyl methacrylate copolymers with methyl methacrylate. Methacryloyl oxypropyl-tris (trimethylsilyl)-siloxane (TRIS) is a typical siloxanyl alkyl methacrylate used in the manufacture of oxygen-permeable rigid lenses as a comonomer with methyl methacrylate and other minor ingredients. **- Elastomeric lenses** are of two types, silicone rubber and acrylic rubber. Most silicone rubber contact lenses are made of crosslinked poly (methyl-phenyl-vinyl siloxanes) which has highest oxygen permeability of all contact lens materials. The acrylic rubber contact lenses are usually made of crosslinked copolymers of n-butyl acrylate with n-butyl methacrylate. **- Hydrogel lenses**, also known as soft contact lenses, can be classified as of low, medium and high water content. Most low water-content hydrogel contact lenses are made from cross linked 2-hydroxyethyl methacrylate polymer. Other type of low-water content hydrogen contact lenses, which are most resistant to surface contamination than other hydrogel lenses, are made of crosslinked copolymers of glyceryl methacrylate and methyl methacrylate. Medium and high-water-content hydrogel lenses usually consist of copolymers of vinyl pyrrolidine with 2-hydroxyethyl methacrylate or methyl methacrylate. Another comonomer used in low and medium water content hydrogel contact lens materials is dialkyl-acrylamide. **Application:** **i)** Contact lenses used for correction of ametropias. **ii)** Contact lenses used to improve the appearance of damaged eyes. **iii)** Contact lenses used to change or enhance color.	**02** **02**
	(d)	**Explain mechanism of blood clot.** **Ans:-** A clot that has formed inside a blood vessel is referred as a thrombus or an embolus depending on whether the clot is fixed or floating, respectively. Two separate routes for activation of the cofactors leading to blood clotting are known as the extrinsic and intrinsic pathways. The extrinsic pathway is so named because it requires a substance not normally present in the blood for activation. Tissue factor is a lipoprotein found in the endothelial cells that line the vascular system and other organs. Damage to tissues or vessels releases tissue factor, which activates factor VII to VIla in the presence of calcium. Factor VIla is a protease that converts factor X to Xa. All the factors in the intrinsic pathway are available in circulation. Factor XII undergoes a conformational change when exposed to collagen, basement membrane or a variety of other foreign surfaces. Once activated XIIa initiates a series of reactions. The central event in clotting is the cleavage of fibrinogen in the presence of the proteolytic enzyme thrombin to a	**04**

		fibrin monomer, and its polymerization to form a fibrin polymer.A fibrin clot is cross-linked fibrinogen in a three-dimensional structure in conjunction with platelets and other wound factors. The generation of fibrin from fibrinogen and thrombin from prothrombin are a part of the common pathway of coagulation. Prothrombin is cleaved to thrombin by a complex of factor Xa, factor Va, phospholipid, and calcium. Factor Xa is a serine protease that attacks prothrombin while factor Va is a cofactor that accelerates the reaction.  	
	(e)	**Classify dialyzer and sketch any one.** **Ans:** Classification of dialyzers : 1. Flat plate 2. Coil-type 3. Hollow fiber  	**02** **02**