



MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

(Approved by AICTE, New Delhi, Accredited by NAAC & Affiliated to Anna University)
 Rasipuram - 637 408, Namakkal Dist., Tamil Nadu



MUST KNOW CONCEPTS

MKC

PHYSICS

2021-22

SUBJECT		21BSS03 – BIO AND NANOMATERIAL SCIENCES		
S.No	Term	Notation (Symbol)	Concept/Definition/Meaning/Units/Equation/ Expression	Units
UNIT-I BIOMATERIALS AND ITS APPLICATIONS				
1	Biomaterial	-	A biomaterial can be defined as any material used to make devices to replace a part or a function of the body.	No unit
2	Biocompatibility	-	Biocompatibility is a general term describing the property of a material being compatible with living tissue.	No unit
3	General classification of biomaterials	-	Metallic, ceramic, polymeric and composite implant materials.	No unit
4	Nitinol	NiTi alloy	Nickel and Titanium alloy	No unit
5	Alumina	Al ₂ O ₃	Aluminum Oxides	No unit
6	Sapphire	-	Natural single crystal alumina known as sapphire	No unit
7	Thermoplastic polymers	-	Thermoplastic polymers can be melted, reshaped and reformed.	No unit
8	Thermosetting plastics	-	The thermosetting plastics cannot be re melted and reused, since the chemical reactions that have taken place are irreversible.	No unit
9	Heart and lung machine	-	The combination of a blood pump and an oxygenator is known as the heart-and-lung machine.	No unit
10	Types of oxygenators	-	membrane oxygenator, bubble oxygenator and film oxygenator.	No unit
11	Classification of Contact lenses	-	1.Rigid 2.Elastomeric 3.Hydrogel lenses	No unit
12	Bandage lenses	-	Therapeutic contact lenses may be considered a bandage on the cornea and thus they have also been called bandage lenses	No unit
13	Contact lens	-	Used to the Correct vision	No unit
14	Intraocular lens	-	Replace lens containing cataracts	No unit

15	Sure Smile Technology	-	A new advanced technology used to take 3D scan of our teeth.	No unit
UNIT –II INTRODUCTION TO NANOTECHNOLOGY				
16	Nanoscale	-	1-100 nm	No unit
17	Nanoscience	-	Nanoscience is the study of structures and materials on the atomic or molecular scale	No unit
18	Nanotechnology	-	Nanotechnology is the ability to create and manipulate structures and materials on the atomic or molecular scale	No unit
19	Surface to volume ratio	-	Surface to Volume ratio and Quantum confinement	No unit
20	Quantum confinement	-	When the dimensions of potential wells or potential boxes are of the order of de Broglie wavelength of electrons or mean free path of electrons, energy levels of electrons change. This effect is called <i>Quantum confinement</i> .	No unit
21	Classification of Nanomaterials	-	Based on the dimension-Zero,One,Two and three dimensional nanomaterials	No unit
22	Zero dimensional Nanomaterials	-	Materials wherein all the dimensions are measured within the nanoscale	No unit
23	One dimensional Nanomaterials	-	One dimension that is outside the nanoscale. 1-D materials include nanotubes, nanorods, and nanowires.	No unit
24	Two dimensional Nanomaterials	-	Two dimensions that are outside the nanoscale. 2-D materials include nanofilms, nanolayers, and nanocoatings.	No unit
25	Three dimensional Nanomaterials	-	All three dimensions are in outside the nanoscale.	No unit
26	Melting point of nanophase materials	-	Melting point of nanophase materials is reduced by reducing the grain size.	No unit
27	Magnetic moment of nanophase material	-	Magnetic moment of nanophase material is increased by decreasing the material size.	No unit
28	Nano aerogel	-	Foam like structures of nanocrystalline material called aerogel is being used for insulation in offices and homes.	No unit
29	Nanomaterials used in automotive applications	-	Nanocrystalline ceramics such as silicon nitride and silicon carbide are used in automotive applications	No unit
30	Magnetic resonance Imaging	MRI	Nanocrystalline Yttrium-Samarium-Cobalt grains possess some special properties and are used in Magnetic resonance Imaging	No unit

UNIT –III SYNTHESIS OF NANOMATERIALS				
31	Two methods in the synthesis of Nanomaterials	-	1) Top down methods 2) Bottom up methods	No Unit
32	Top down Method	-	Under this process of fabrication, bulk materials are broken into nano-sized particles.	No Unit
33	Bottom up method	-	Bottom-up approach refers to the building up of a material from the bottom, i.e., atom by atom, molecule by molecule, or cluster by cluster.	No Unit
34	Common approaches of top-down method	-	(i) Ball milling method (ii) Plasma arcing (iii) Laser sputtering (iv) Vapour deposition method	No Unit
35	Common approaches of bottom-up method	-	(i) Sol-gel method (ii) Colloidal method (iii) Electro deposition (iv) Solution phase reductions	No Unit
36	Principle of Electro deposition method	-	When current is passed through the electrodes immersed in the electrolyte, certain mass of the substance liberated at one electrode and gets deposited on the surface of the other.	No Unit
37	Plasma arcing method	-	This technique is used for the production of nanoparticles by generating plasma using heating coils at radio frequency	No Unit
38	Principle of Ball milling method	-	The rolling balls give force to particles, while the falling balls provide head-on impacts with high kinetic energy.	No Unit
39	Pulsed laser deposition method	PLD	The high power laser pulse is used to melt, evaporate and ionize the material from the surface of a target.	No Unit
40	Chemical Vapour Deposition method	CVD	Deposition of a solid on a heated surface from a chemical reaction in the vapour phase	No Unit
40	Advantages of coprecipitation method	-	High yield, Product purity and low cost	No Unit
41	Potential of hydrogen value	pH	pH describes the degree of acidity or alkalinity of a solution	No Unit
42	Lithography	-	It is used to pattern specific shapes of a thin layer on a rigid substrate for fabricating electrical devices.	No Unit
43	Some types of lithography	-	Optical, Electron ,X-ray and ion beam lithography	No Unit
44	Electron beam lithography	EBL	The process of tracing out a pattern in a suitable recording medium using a focused e-beam.	No Unit
45	Examples for Active Nanostructures	-	i) 3D transistors, ii) amplifiers, iii) targeted drugs, iv) actuators,v) adaptive structures	No Unit

UNIT-IV CHARACTERIZATION OF NANOMATERIALS

46	Characterization of Nanomaterials	-	Determining the structural,optical,magnetic, and mechanical properties of the materials depending on their applications.	No Unit
47	Structural characterization	-	Determining the morphology and materials composition of nanomaterials	No Unit
48	X ray diffraction analysis	XRD	It is a technique used in materials science to determine the crystallographic structure of a material	No Unit
49	Principle of X ray diffraction	-	Constructive interference of monochromatic x rays and a crystalline sample.	No Unit
50	Principle of Raman spectrometer	-	It is a analytical technique where scattered light is used to measure the vibrational energy modes of a sample.	No Unit
51	Scanning Electron Microscope	SEM	SEM is a type of electron microscope that images the sample by scanning it with a high energy beam of electrons in a raster scan pattern	No Unit
52	Morphology study		Study of size,shpe and order of particle in a sample	No Unit
53	Advantages of Transmission Electron Microscope	TEM	Compare with SEM, they have High magnification, High resolution, High quality images	No Unit
54	Advantages of Atomic Force Microscope	AFM	Easy sample preparations, accurate height information, works in vacuum, air, and liquids, living systems can be studied.	No Unit
55	Differential Scanning Calorimetry	DSC	SC measures the temperatures and heat flows associated with transitions in materials as a function of time and temperature.	No Unit
56	Principle of electron microscope	-	In electrons microscope the electrons have shorter wavelength that allows greater magnification.	No Unit
57	Magnetic lens	-	The lenses used in electron microscope are magnetic lens, used to focus or diverse the electron beam	No Unit

UNIT-V CARBON NANOMATERIALS

58	What is carbon nanotube?	CNT	New form of rolled carbon sheets in nanoscale	
59	Classification of CNT		Single walled nanotubes and Multi walled nanotubes	No Unit
60	Size of CNT		50,000 times smaller than the width of human hair	No Unit
61	What is carbon?	C	Carbon is a non-metal in group 14 of the periodic table, it has 4 valence electrons	No Unit
62	Hydrocarbon		Compounds that contains only carbon and hydrogen are called hydrocarbon	No Unit

63	Formation of CNT		When graphite sheet of one atom thickness are rolled into a cylinder with the diameter in the order of few nanometers it is called CNT	No Unit
64	Single walled carbon nanotubes	SWCNT	If the wall of CNT contain only one layer,that is called as SWCNT.	No Unit
65	Multi walled carbon nanotubes	MWCNT	If the wall of CNT contain more than one layer,that is called as MWCNT.	No Unit
66	Types of multi walled carbon nano tube	-	Russian doll model and Parchment model	No Unit
67	Russian doll		Sheets of graphite are arranged in concentric cylinders	No Unit
68	Parchment model		Single sheet of graphite is rolled to form a tube with multilayer	No Unit
69	Some methods to prepare CNT		Arc discharge method- chemical vapour deposition method –laser ablation method	No Unit
70	Any two properties of CNT		i) CNTs have very high elastic modulus and tensile strength ii) Electrical current density is 1000 times greater than the silver or copper.	No Unit
75	Some applications of CNT		i) Flat panel displays ii) Development of fuel cells iii) Cloths, sports equipments, space elevator	W/m-k
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