PH.D ENTRANCE TEST.
MODEL QUESTION PAPER-MATERIALS SCIENCE.

Section-I : Give answer (Each question carries one mark) Total: 10 marks

1) Define entropy.

2) Define polycrystalline material.

3) How Ionic bonds are formed?

4) What is stress?

5) What is thermosetting material?

6) What is HDT?

7) Define melt flow index?

8) Differentiate between pressure and vacuum?

9) Which polymerization technique is used to form latex type of polymers?

10) What is creep?

Section-II (Multiple choices) (Each question carries one mark) Total: 40 marks

Select the correct answer (Put tick mark)

1) Ceramics are
   a) Organic material
   b) Inorganic material
   c) Highly conducting material
   d) None of above
2) Macrostructure is the structure of a material at a length scale of
   a) ~ > 1000- 100,000 nm
   b) ~1-100 nm
   c) ~ 10- 1000 nm
   d) All Above
3) Dislocation density represent the
   a) Amount of water present
   b) Length of dislocations present
   c) Amount of dislocations present
   d) None of above
4) ASTM means
   a) Asia Society for testing and materials
   b) Asia society for types of materials
   c) American society for types of material
   d) American society for testing and materials
5) Plastic deformation is
   a) recoverable
   b) non-recoverable
   c) elastic
   d) None of above
6) Which one is ceramic
   a) Mullite
   b) Osmium
   c) Molybdenum
   d) Zinc
7) Newtonium materials in which the shear stress and shear strain rate are
   a) Not linearly related
   b) Linearly related
   c) Inversely related
   d) None of above
8) Stain is
   a) Elongation change in dimension/unit length
   b) Elongation change in dimension × unit length
   c) Dislocation change in dimension/ unit length
   d) Dislocation change in dimension × unit length

9) Metals are generally
   a) Brittle
   b) Ductile
   c) Insulator
   d) All of above
10) Deformation process for cold working is
   a) Rolling
   b) Forging
   c) Drawing
   d) All of above
11) In the annealing, during the recrystallization step dislocation density
   a) Increases
   b) Decreases
   c) Remain Same
   d) None of above
12) When the temperature and pressure both vary, the Gibbs Phase rule is
   a) 2+C=F+P
   b) 2-C=F+P
   c) 2+C=F-P
   d) None of above
13) In effective dispersion strengthening of alloy
   a) Matrix should be soft
   b) Dispersed phase should be small particles
   c) Dispersed phase particles should be round
   d) All above are true
14) In eutectic reaction
   a) One liquid phase solidifies to produce two solid phases
   b) One solid phase transforms to two different solid phases
   c) One liquid transforms to a solid & a second liquid on cooling
   d) None of above
15) Which one is used as a reinforcement for making composites
   a) Epoxy Resin
   b) Phenol formaldehyde resin
   c) Polyurethane resin
   d) Carbon fiber
16) The intermolecular force between linear chain of LDPE is
   a) H-bond
   b) Covalent bond
   c) Ionic bond
   d) Vandar waal force

17) Oxidative degradation process of polystyrene can be prevented by the addition of
   a) Calcium chloride
   b) Phenyl naphthyl amine
   c) Benzoyl peroxide
   d) Methyl amine
18) Poly(methyl methacrylate) is transparent as it is
   a) Crystalline
   b) Amorphous
   c) Liquid
   d) Gas
19) For an ideal elastic body
   a) Stress is not proportional to strain
   b) Stress is proportional to strain
   c) None of these above
20) Polyethylene terephthalate(PET) is a polymer of
   a) Adipic acid and ethylene glycol
   b) Adipic acid and hexamethylene diamine
   c) Ethylene glycol and dimethyl terephthalate
   d) None of above
21) A small molecule is eliminated as a byproduct during the synthesis of
   a) Polycaprolactone
   b) Polystyrene
   c) Polyisoprene
   d) Nylon 6,6
22) For free radical copolymerization of monomers M_1 and M_2, the value of reactivity ratios r_1 and r_2 are both found to be one, the resulting copolymer is
   a) Alternate
   b) Block
   c) Random
   d) Branched
23) High pressure technique is used for the mass production of
   a) PVC
   b) HDPE
   c) SAN
   d) LDPE
24) For the preparation of hard rubber, the amount of sulphur used is
   a) 2-3 phr
   b) 35-40 phr
   c) 0.1 phr
   d) None of above

25) PVC is graded by
   a) Melt flow index
   b) Solution viscosity parameter
   c) Heat distortion temperature
   d) None of above

26) Mastication of rubber is carried out in
   a) Two roll mill
   b) Autoclave
   c) Brabender plasticorder
   d) None of above

27) Catalyst used for anionic polymerization process is
   a) BF_3
   b) BuLi
   c) H_2SO_4
   d) None of above

28) Degree of crystallinity of polymers can be measured using the instrument
   a) EDAX
   b) SEM
   c) WAXS
   d) None of above

29) Ductlity is
   a) measure of the degree of elastic deformation
   b) measure of the degree of plastic deformation
   c) measure of stress-strain behaviour
   d) None of above

30) Specific volume change of a polymer can be measured using
   a) Calorimeter
   b) Dilatometer
   c) Picnometer
   d) None of above

31) The conductivity of a conductor is due to
   a) valence electrons in a conductor
   b) ions in a conductor
   c) valence electrons and positive holes in a conductor.
   d) None of above

32) The resistivity of a metal _____ with increase in temperature
   a) increases
   b) decreases
   c) first increases and then decreases
   d) None of above

33) The X-ray used for the diffraction of crystalline solids lies between
   a) ultraviolet and gamma rays
   b) infrared and visible rays
   c) ultraviolet and visible rays
   d) None of above

34) An intrinsic semiconductor has
   a) equal number of electrons and positive holes
   b) electrons as majority and holes as minority carriers
   c) holes as majority and electrons as minority carriers
   d) None of above

35) The intensity of magnetization of a body is defined as
   a) magnetic moment/volume
   b) magnetic moment X area
   c) magnetic moment X volume
   d) None of above

36) The magnetic dipole moment of a body is measured in units of
   a) A/m
   b) $A\ m^2$
   c) Wb/m^2
   d) $Wb\ m^2$

37) If the distance between the plates of a parallel plate capacitor is initially small and then is doubled, the capacitance is
   a) Doubled
   b) Halved
   c) increases by a factor of 4
   d) does not change

38) Unit of frequency is
   a) Hz
   b) Pa
   c) Meter
   d) None of above

39) A material that exhibits zero electrical resistance under certain conditions are
   a) Insulators
   b) Superconductors
   c) Conductors
   d) None of above

40) In ferromagnetism the alignment of magnetic moments of atoms are
   a) in the same direction
   b) in an antiparallel
   c) in a hexagonal manner
   d) none of above

Section III: (Answer the following short questions) Total: 25 marks
(Each question carries five marks)

1) Give the five most important three phase reactions in binary phase diagrams.

2) **Discuss various moulding processes used for the processing of plastics.**

3) **Give the brief account of the dielectric properties of the materials.**

4) **Explain pultrusion process for making polymer-matrix composites.**

5) **Explain the curing reactions of novalac and epoxy resins.**

Section IV: Attempt any two of the following long questions

Total: 25 marks

1) Mention and discuss in brief the methods used for the characterization of ceramics, composites, polymers and semiconductors.
2) Give a brief account of different types of composite materials based on various matrix and reinforcement with atleast one example of each type.
3) Give a brief account of different polymerization techniques used for the mass production of polymers.