# 1904N284

Candidate's Seat No : _____

**M.Sc Semester-2 Examination**

**409**

**Polymer Science**

**April-2024**

**Time : 2-30 Hours]** **[Max. Marks : 70**

**Subject Name: Analysis and Characterization of Polymers**

***General Instructions***

1. ***All question is compulsory***
2. ***Draw neat figure wherever necessary***

Q-1(a). Explain the viscosity average technique for molecular weight determination and discuss the use of Mark–Houwink equation for the same. [7 Marks]

**OR**

Q-1(a). Describe Gel Permeation Chromatography (GPC) technique for determination average molecular weight of polymer. [7 Marks]

Q-1(b). Discuss colligative properties of polymers. Give basic principal of different methods used for the determination of these properties. [7 Marks]

**OR**

Q-1(b). What is TGA? Explain its working principle, sample preparation and measurement method, and applications in details.

Q-2(a). What is DSC? Explain its working principle, sample preparation and measurement method, and applications in details. [7 Marks]

**OR**

Q-2(a). What is dynamic mechanical analysis? Explain its working principle, sample preparation and measurement method, and applications in details.

Q-2(b). What is DSC? Explain its working principle, sample preparation and measurement method, and applications in details. [7 Marks]

**OR**

Q-2(b). Explain X-ray diffraction analysis technique, and give Bragg's equation with its usefulness. [7 Marks]

Q-3(a). Write a basic working principal of SEM, TEM and AFM, and give applications of each characterization technique. [7 Marks]

**OR**

Q-3(a). Write note on UV/Visible Spectroscopy and explain Lambert law and Beer's law. [7 Marks]

Q-3(b). Explain $^{1}H$ NMR spectroscopy in details. [7 Marks]

**OR**

Q-2(b). Explain $^{13}C$ NMR spectroscopy in details. [7 Marks]

Q-4(a). Discuss methods for determination of total alkalinity of rubber. [7 Marks]

**OR**

Q-4(a). Describe methods for determination of epoxy equivalent and amine value of resins. [7 Marks]

Q-4(b). Explain systematically the methods for evaluation of acid value and hydroxyl value of resins. [7 Marks]

**OR**

Q-4(b). Write basic working principal, instrumentation and methods for Fourier transformer infrared (FTIR) spectroscopy and its application. [7 Marks]

**Q–5 ANSWER ANY SEVEN QUESTIONS OUT OF TWELVE**

**[Max. Marks: 7×2=14]**

(i) Write working principal of differential thermal analysis (DTA). (Fill in the Blank)
(ii) Light scattering technique is used for measurement of _____average molecular weight of polymer. (Fill in the Blank)
(iii) Give full form of GC-MS and TEM.
(iv) What is isocyanate index of resin?
(v) Beer Lambert's law gives the relation between energy absorption and concentration (say true or false)
(vi) In chromatography, the stationary phase can be _____ supported on a solid.
  (a) Solid or liquid
  (b) Liquid or gas
  (c) Solid only
  (d) Liquid only
(vii) Which of the following is not a feature of carrier gas used in gas chromatography?
  (a) Chemically inert
  (b) Suitable for the detector employed
  (c) Highly Pure
  (d) None of the above
(viii) Spectroscopy deals with interaction of electromagnetic radiation with _____ (Fill in the Blank).
(ix) Electromagnetic radiation can travel through a vacuum. (say true or false)
(x) Which type of the following sample is not used in X-ray diffractometers to identify the physical properties?
  (a) Metals
  (b) Liquids
  (c) Polymeric materials
  (d) Solids
(xi) Write working principle of Mooney viscometer.
(xii) Define Chemical Shift in NMR.

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