

ANDHRA PRADESH
RECRUITMENT OF ASSISTANT PROFESSORS IN THE UNIVERSITY
SYLLABUS FOR THE SCREENING TEST

Paper – II

Paper II will cover 180 Objective Type Questions (Multiple Choice, Matching type, True/False, Assertion – Reasoning type) carrying 180 marks of 3 hours duration. Each question carries 1 mark. There will be negative marks for wrong answers. Each wrong answer will be penalized @ 1/3rd of the marks prescribed for the question.

Polymer Science & Technology

Genesis of polymers – Historical development – Definitions – How are polymers made – Polymer chemical structures – classification – Thermoplastics & Thermosets.

Molecularweight & size-average molecular weight – number average and weight average molecular weight – sedimentation and viscosity – average molecular weight – molecular weight and degree of polymerization – poly dispersity and molecular weight distribution in polymers – significance of molecular weight – size of polymer molecules.

Chemistry of polymerization – introduction – chain polymerization – step polymerization – miscellaneous – polymerisation reactions – polymerization techniques.

Crystallinity in polymers – crystalline solids and their behaviour – polymers and X-ray diffraction – degree of crystallinity – crystallinity – polymer crystallisation – crystallites – structural regularity and crystallisability – other factors affecting crystallisability – helix structures – spherulites – polymer single crystals – effect of crystallinity on the properties of polymers.

1. Molecular weight determination: The existence of molecular weight distributions – definition of weight average, number average and viscosity average. Determination of number average molecular weight (M_n) – End group analysis – cryoscopic methods. Ebulliometric methods. Membrane osmometry. Vapor phase osmometry. Comparison of data. Determination of weight average molecular weight M_w . Light scattering by larger particles – equilibrium – ultracentrifugation method – solution viscosity method.

2. Glass transition temperature – Glassy solids and glass transition – transitions and associated properties – factors influencing glass transition temperature – Glass transition temperature and molecular weight – plasticizers – Glass transition temperature of copolymers – Glass transition temperature & melting point – importance of glass transition temperature.

3. Chemistry of polymerization – main features of chain growth & step growth polymerizations. Different methods of chain growth polymerization. Free radical polymerization – methods of producing free radicals – mechanism of free radical polymerization – chain transfer – inhibition and retardation. Ionic polymerization – cationic and anionic polymerisation – living polymers. Co-ordination polymerization. Structure of Ziegler Natta catalysts – polymerisation mechanism.

4. Ring opening polymerisation – polymerizability of cyclic monomers – Polymerizability of cyclic monomers – Thermodynamic & kinetic considerations – Ring-opening polymerization of cyclic ethers – anionic polymerization of epoxides – cationic polymerization – polymerization of cyclic amides – Hydrolytic polymerization – cyclic polymerization of lactones.

5. Polymer degradation & stabilization –types of degradation – Thermal degradation – Thermal degradation – Photo degradation & stabilisation – mechanical degradation – Solvolytic degradation – Hydrolytic degradation – oxidative degradation – Biodegradation.

6. Industrial Polymers.

Polyesters – Polyethylene terephthalate – Polybutylene terephthalate. Polyamides – Nylons – Polyolefines – Polyethylene – Polypropylene – Polystyrene.

7. Polymer solutions – The process of polymer dissolution – Nature of polymer molecules in solution – Size and shape of macromolecules in solution – viscosity of dilute polymer solutions – viscometry of concentrated polymer solutions.

CHEMISTRY

1. Molecular spectroscopy: Basic principles- Fundamentals of electronic spectra-infra red-microwave-raman-NMR & ESR- Mossbauer spectroscopy. (Fundamentals of Molecular spectroscopy by C.C Banwel).
2. General Inorganic Chemistry – redox reactions – modern concepts – oxidation number – balancing of oxidation-reduction reactions – oxidation-reduction potentials.
(b) Acids and bases- modern concepts of acids and bases – pearson theory of hard & soft acids and bases, buffer solutions – Ph, pKa and pKb scales.
3. (a) Co-ordination Chemistry-bonding in metal complex – important aspects of crystal field Theory – its applications and limitations.
(b) Inorganic Polymers: silicones-metal chelate polymers.
Ref: Fundamentals of Inorganic chemistry by E.S. Gilreath
Chemistry of co-ordination compounds by F. Basolo & R. Tohmsi.
4. Stereo Chemistry-optical isomerism- symmetry rules – Absolute configuration-R&S concepts – Asymmetric induction (Cram's rules) stereo-specific addition to carbon – carbon double bond. Cis-Trans isomerism of C=C systems – E, Z configuration-stereo isomerism of aldoximes & ketoximes – Beckmann rearrangement.
5. Mechanistic Organic chemistry – Nucleophilic substitution at saturated carbon – SN1 and SN2 mechanism. Structure and solvent effects – Neighbour group participation-solvent effects –Aromatic electrophilic substitution-Friedel craft's acylation-alkylation-diazocoupling reaction.
Ref: Chapter-III &IV Organic chemistry by Morrison & Boyd.
Organic chemistry by I.L. Finar
6. Equilibrium thermodynamics & Electro Chemistry
(a) Entropy and its change in reversible and irreversible processes – Gibbs –Helmoltz equations- Vant Hoff reaction isotherm-third law of thermodynamics test for validity of third law.
Electro chemistry: theory of electrolytic conductance –Debye-Huckle & Onsager equation-wien effect – Falkehagen effect – experimental verification of onsager equation.
(b) EMF Measurements: Thermodynamics & kinetic derivation of Nernst eqn.
7. Chemical Kinetics: Theories of homogeneous gas phase reaction rates – Unimolecular, bimolecular, termolecular reaction, complexing reaction – opposing, consecutive & Parallel reactions-chain reactions – stationary & non stationary types – exploring limits. Mechanism and rate expression for hydrogen chloride, hydrogen bromide and hydrogen – oxygen reactions.
Ref: Text book of Physical Chemistry by Glasstone.

PHYSICS

Atomic spectra : Quantum number for atom-fine structure of hydrogen lines-stern and gerlach experiment-spectral terms and their rotational energy level diagrams for complex atom, L-S coupling terms-landes g factor in L-S and J.J.Coupling, Zeeman, paschen-Back and stark effect.

Molecular Spectra : Bore-Oppenheimer approximation-Elementary concepts of LCAO-Rotational spectra- Vibrational spectra-electronic spectra-vibrational isotope effect-frank condon principle-dissociation energies.

U V and Visible Spectroscopy : Beer-Lambert Law single and double beam spectrophotometers of visible & Ultraviolet spectroscopy-Applications of vis spectroscopy-structure of organic and inorganic compounds like lactone & lactam, tyrosine. Geometrical isomerism-Theory of U.V.Spectra-U.V.absorption spectrum of Benzene vapour, Detection of impurities. Structure of chloral.

I.R & Raman Spectroscopy : The vibrations of poly atomic molecules-I.R. & double beam spectrophotometers, Analysis of I.R. technique-Thymidine-Thio acetic acid-classical theory of Raman effect-vibrotation – Raman CO₂, N₂O, So₂ molecules.

Semi conducting Materials : Elemental, intermettalic, III-V, III-VI Compounds and organic semi conductors- Statistics of charge carriers in intrinsic and extrinsic semi conductors characterization of semi conducting materials-conductivity & Hall effect.

Complex Materials : Classification and basic properties of amorphous materials-glasses-ceramic materalis-liquid crystals polymers composite materials-basic concepts.

Operational Amplifier Fundamentals : Block diagram of Op.Amp., Characteristics of the ideal Op-Amp Inverting and non-inverting configurations of Op-Amp., and analysis, Op-Amp. Specification-D.C. off set voltage, D.C.Offset current, common mode rejection ratio and slow rate different Op. Amp configurations-voltage follower, current follower and differential Amplifier. Frequency response of Op.Amp- Amplifier gain and frequency response. Slow rate and output voltage, Noise in the output voltage and external frequency compensation.