JABALPUR ENGINEERING COLLEGE, JABALPUR (M.P.)

Scheme of Examination w.e.f. July, 2018 batch

THIRD SEMESTER (M.Sc. Applied Chemistry)

S.No.	SUBJECT CODE	SUBJECT	Periods Per Week				Maximum Marks (Theory Slots)			Maximum marks (Practical Slots)		Total Marks
			L	T	P	Total Credits	End Exam	Mid Sem Exam	Assignment/ Quiz	End Semester Practical/ Viva	Practical/ Record/ Assignment/ Quiz/ Presentation	
1	AC3001	Inorganic Chemistry-III	3	1		4	70	20	10			100
2	AC3002	Organic Chemistry- III	3	1		4	70	20	10			100
3	AC3003	Physical Chemistry-III	3	1		4	70	20	10			100
4	AC3004	Analytical Chemistry-I	3	1		4	70	20	10			100
5	AC3005	Inorganic Chemistry-III			4	4				40	25	65
6	AC3006	Organic Chemistry-III			4	4				40	25	65
7	AC3007	Physical Chemistry-III			4	4				40	25	65
8	AC3008	Analytical Chemistry-I			4	4				40	15	55
			12	4	16	32	280	80	40	160	90	650

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Applied Chemistry

M.Sc. III SEMESTER

Course AC3001 (PAPER: Inorganic Chemistry-III)

(Effective From : July 2019)

Maximum Marks 70
Minimum Marks 28

UNIT I

Electron Spin Resonance Spectroscopy:

Basic principles, hyperfine and superfine splitting, g value and factors affecting g values. Application to transition metal complexes.

Unit II

Organometallic Chemistry of Transition Elements

Ligand hepticity, electron count for different types of organometallic compounds, 18 and 16 electron rule exceptions, synthesis. Structure and bonding. Organometallic reagents in organic synthesis and in homogeneous catalytic reactions (Hydrogenation, Hydroformylation, Isomerization and Polymerization), π-metal complexes, activation of small molecules by coordination

Unit III

Nuclear Magnetic Resonance Spectroscopy

NMR shift, Reagents, shift mechanism and its utility in simplification of NMR spectra. Application of NMR in characterization of coordination compounds.

Unit IV

Nitrogenous and Phosphate Fertilizers

General principles involved in manufacture of Urea, Ammonium sulphate, Ammonium nitrate and Cynamide, Superphosphate fertilizers, Potassium nitrate, Potassium sulphate. Role and deficiency symptoms of micronutrients. Bio fertilizers, its classification, demand and production.

Unit-V

Biochemistry of some important Bio metals, Storage, Transport and Activity

Biochemistry and metabolism of Iron, Copper. Biochemistry of Zinc and Calcium. Role of Vanadium, Chromium, Manganese, Cobalt, Molybdenum, Tungsten and Nickel in biology

Books Suggested

1. Advanced Inorgnic Chemistry,F.A.Cotton and Wilknson,John Wiley.
2. Inorganic chemistry, J.E.Huhey,Harpes &Row.
3. Chemistry of the Elements,N.N.Greenwood and A.Earnshow,Pergamon.

4. Inorganic Electronic Spectroscopy, A.B.P. Lever, Elsevier.
5. Megnetiochemistry, R.1.Carlin Spronger Verlag.
6. Comprehensive Coordination Chemistry eds.,G.Wilkinson,R.D.Gillars and J.A.McCleverty, Pergamon.
7. Synthesis and characterization of some novel nitrosyl compounds, R.C. Mourya Pioneer Publication, Jabalpur,2000.
8. Chemical Applications of Group Theory. F.A.Cotton, John Wiley.
9. Essential of nuclear chemistry, H.J.Arnikar.
10. Chemistry in non-aqueous solvents, H.S.Sisler Reinhold Publishing corporation, USA, 4Th edition (1965),.

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Applied Chemistry

M.Sc. III SEMESTER

Course AC3002 (PAPER: Organic Chemistry-III)

(Effective From : July 2019)

Maximum Marks 70
Minimum Marks 28

UNIT I

Selected Organic Reactions and Reagents

Allylic Rearrangement, Baeyer-Villiger ,Birch reduction, Curtuis Reaction, Freidall- Crafts Reaction Fries Rearrangement, Michael Reaction, Reformatsky Reaction, Ullmann Reaction,Wolf Kishner Reduction.

Anhydrous Aluminium Chloride, N-Bromosuccinimide (NBS), Dicyclohexylcarbodiimide, Fentons reagent, Lead Tetraacetate $(CH_3COO)_4Pb$, Osmium Tetroxide(OsO_4), Periodic acid: Sodium Borohydride ($NaBH_4$), Wilkinsons Catalyst, Ziegler-Natta Catalysis.

UNIT II

Organic Photochemistry

Photochemical processes. Energy transfer, sensitization and quenching. Singlet and triplet states and their reactivity. Photoreactions of carbonyl compounds, enes, dienes and arenes. Norrish reactions of acyclic ketones. Patterno-Buchi, Barton, photo-fries and Di-π methane rearrangement reactions. Photoreactions of vitamin-D. Photochemistry of vision and photosynthesis. Singlet oxygen generation and reaction. Application of photoreactions and their applications for industrial synthesis.

UNIT III

Green Chemistry

Introduction to the principles of green chemistry – prevention of waste, atom economy, less hazardous chemical syntheses, designing safer chemicals, safer solvents and auxiliaries, design for energy efficiency, reduce derivatives, renewable feedstock, catalysis, design for degradation, real time analysis for pollution prevention and inherently safer chemistry for accident prevention. Green synthesis, clean routes using supercritical solvents, ionic liquids and water.

UNIT IV

Chemistry of Drugs and Pharmaceuticals

Classification of drugs based on activity. Synthetic procedure for the present commonly used drugs of each type, Manufacturing of few important drugs, Semi synthetic penicillin's. Vitamins: type of vitamins, synthesis of Vitamin-A and Vitamin-E, Vitamin–II of niacinamide, use of NMR in structure determination of drugs and pharmaceuticals: Instrumentations and applications.

UNIT V

(A) Heterocycles

Six membered heterocycles with one heteroatom: Synthesis and reaction of pyrilium salts and pyrones and their comparison, pyridinium and thiopyrylium salts and pyridones. Synthesis and reaction of coumarins and chromones.

Six membered heterocycles with two and more heteroatom: Synthesis and reaction of diazines and triazines.

Seven membered heterocycles: Synthesis and reaction of azepines, oxelines and thiepines.

(B) Study of the following compounds and their reactivity

(a) Aromaticity of annulenes, mesoionic compounds (syndones), ferrocene and azulene.

(b) Study of the following; Fullerenes, Crown ethers, cyclodextrins, cryptands, catenanes and rotananes.

(c) Study of the following; Benzo-fused aromatic compounds: Indoles, Quinolines and Isoquinolines, Coumarins heterocycles.

(d) Hammett equation and its applications.

Book Suggested

1. Organic Chemistry, J.Claden, N. Greeves, S. Warren, P. Wothers, Oxford University Press.
2. Advanced Organic Chemistry- Reactions, Mechanism and Structure, Jerry March, Wiley-Interscience.
3. Organic Chemistry, L.G. wade, Jr, Pearson Education Asia.
4. Organic Chemistry , P.Y.Bruice, Pearson Education.
5. Advanced Organic Chemistry, F.A. Carey and R. J.Sundberg, Plenum.
6. Organic Chemistry, J. McMurry, Thomson Asia.
7. Organic Chemistry, T.W.G. Solomons and C.B. fryhle, John Wiley (Asia)
8. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
9. Organic Chemistry, R.T. Morrison and R.N.Boyd, Prentice-Hall.
10. Sterochemistry of Organic Compounds. E.L.Eliel and S.H. Wilen, John Wiley (Asia)
11. Sterochemistry of Organic Compounds. D.Nasipuri, New Age International.
12. Sterochemistry of Organic Compounds. P.S.Kalsi, New Age International.
13. Inroduction to Specroscopy, D.L.Pavia, G.M.Lampman and G.S. Kriz, Thomson , Brooks/ Cole.
14. Organic Spectroscopy, W. Kemp, ELBS, Macmillan.
15. Spectrometric Identification of Oraganic Compounds, R.M. Silverstein, G.C. Bassler and T.C.Morrill. John Willey
16. Applicatio of Spectroscopy of Oraganic Compounds, J.R. Dyer, Dyeer, Prentice Hall.
17. Spectroscopic Methods in Organic Chemistry. D.H.Willams, I. Fleming. Tata McGraw-Hill.

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Applied Chemistry

M.Sc. III SEMESTER

Course AC3003 (PAPER: Physical Chemistry-III)

(Effective From : July 2018)

Maximum Marks 70
Minimum Marks 28

Unit I:

Electrodes

Different types of electrodes, Electrochemical cells, Concentration cell and activity coefficient determination. Origin of electrode potential. Liquid junction potential. Evaluation of the thermodynamic properties. The electrode double layer: Electrode-electrolyte interface. Theory of multiple layer capacity. Electrocapillary. Lippmann potential, Membrane potential. Electrokinetic phenomena. Mechanism of charge transfer at electrode-electrolyte interface. Electrolysis. Current potential curve. Dissolution, deposition and decomposition potentials. Energy barrier at metal-electrolyte interface. Different types of overpotentials. Butler-Volmer equation. Tafel and Nernst equation. Rate determining step in electrode kinetics. The hydrogen overvoltage. The oxygen overvoltage. Theories of overvoltage.

Unit II:

Application of Catalysis

Selection, preparation, and evaluation of catalyst -test reaction, promoters, carriers and stabilizers. Mechanism of selected reaction: hydrogenation and dehydrogenation reaction – dehydration of alcohol, olefin hydrogenation, decomposition, of nitrous oxide, oxidation of CO, Ketonization of carboxylic acids, cracking of hydrocarbons.

Applications: petrochemicals industry – reforming and refining – value added chemicals – environmental protection auto exhaust catalyst, novel catalytic material clusters - zeolites, mesoporous materials.

Electrocatalysis and photocatalysis

Unit III:

Crystal Defects

Perfect and imperfect crystals, stoichiometric and non-stoichiometric defects, intrinsic and extrinsic defects, point defects, line and plane defects, Schottky and Frankel defects.

Solid State Reactions. General Principles, coprecipitation as a precursor of solid state reactions, factors affecting solid state reactions.

Unit IV:

Electronic Properties and Band Theory

Metals, insulators and semiconductors, Electronic structure of solid-band theory; band structure of metals, insulators and semiconductors. Intrinsic and extrinsic semiconductors, doping semiconductors, p-n junctions, superconductors.

Unit V:

Emulsion

Type of emulsion, theories of emulsions, and emulsion stability, identification of emulsion types, inversion emulsion, microemulsion: theory and application, micellization, structure of micelle, reverse micelle, solubilization of water insoluble organic substances.

Recommended Books: -

1. A Test Book of Physical Chemistry by Samuel Glastone.Pub. Maxmillian Student Editions.
2. A.K. Chandra, Introduction to Quantum Chemistry, Tata Mc Graw Hill.
3. Physical Chemistry by Gordon M.Barrod Pub. International Science Edition Mc Graw Hill
4. A Test Book of Physical Chemistry by Irs N Levis Pub. Mc Graw Hill Int. Book Co.
5. Physical Chemistry by Gurdep Raj & Chatwal Pub. Goel Pub. Meerut
6. Test Book of Physical Chemistry by Negi & Ananl Pub. Wiley E. Ltd.

Applied Chemistry

M.Sc. III SEMESTER

Course AC3004 (PAPER: Analytical Chemistry-I)

(Effective From : July 2018)

Maximum Marks 70
Minimum Marks 28

Unit-I

Statistical Analysis. Emphasis should be placed on numerical problems. Significant figures. Accuracy and precision. Errors, systematic and random errors. Propagation of errors. Standard deviation. Coefficient of variation. Confidence limit. Significance test. T-Test, F-Test. Rejection of a result. The least squares method for deriving calibration graph. Correlation coefficient. Limit of detection.

Sample Preparation for chromatography. Solid-phase extraction, solid phase microextraction. Extraction with molecular imprinted polymers.

Unit II

Chromatography. Theory of Chromatography. Retention time. Capacity factor. Number of theoretical plates, and plate height. Band broadening. Van Deemter equation. Column resolution.

Gas Chromatography. Instrumentation. Columns. Detection: flame ionisation detector, thermal conductivity detector and mass spectrometer.

High-performance Liquid chromatography. Instrumentation. Pumping systems. Sample injection system. Columns. Detection: UV-Vis detector, photodiode array detector, fluorescence detector, refractive index detector and mass spectrometric detection.

Capillary Electrophoresis. Principle, modes of operation, and instrumentation.

UNIT III

BASIC PRINCIPLES AND ROTATIONAL-VIBRATIONAL SPECTRA:

(A) The electromagnetic spectrum. Interaction of electromagnetic radiation with molecular system, selection rules. Principles of atomic and molecular spectroscopy.

(B) Pure rotational spectra-rotational energy levels, theory of rotational spectra, application of rotational spectra to the study of structure of molecules, calculation of bond lengths of diatomic molecules.

(C) Vibrational-rotational spectra- Theory of vibrational spectra of simple diatomic molecules, instrumentation, Application of infrared spectra in the structure elucidation of organic and inorganic molecules, Limitations of I.R. spectra.

(D) ELECTRONIC SPECTRA:

Beer-Lamberts law, theory of electronic spectra, Franck-Condon principle, types of electronic transition, chromophore concept, auxochrome, solvent effect, effect of conjugation, conjugated dienes, Woodward fieser rules for conjugated dienes and trienes, applications of U.V-Vis spectroscopy in the structure elucidation of organic compounds, inorganic complexes, idea of charge transfer spectra.

UNIT IV

RAMAN SPECTROSCOPY & Mass Spectrometry

(A) Raman spectroscopy – Raman effect, theory of Raman spectra, instrumentation, difference between Raman spectra & I.R. Spectra, application of Raman spectra in inorganic and organic molecules.

(B) Mass Spectrometry – Principle of mass spectra, instrumentation, fragmentation pattern, application of mass spectra to simple molecules, identification of unknown compounds, determination of bond strength.

UNIT V

(A) Nuclear magnetic resonance spectroscopy- NMR, NMR absorption by nuclei. Theory of NMR spectra, chemical shift, shielding effects, deshielding effects, coupling constant, double resonance, nuclear overhauser effect (NOE), NMR spectra at more than one ratio frequency.

^{13}C NMR spectroscopy.

(B) Electron spin resonance Spectroscopy-Theory of ESR spectroscopy. Instrumentation, choice of solvents, Hyperfine splitting, application of ESR spectroscopy.

Reference Books:

1. J.C. Kuriakose and J. Rajaram, "Chemistry in Engineering and Technology", Vol.1 & 2, Tata Mcgraw Hill Publishing Company (P) Ltd., New Delhi.
2. Engineering Chemistry – Gopalan Venkappayya, Vikash Publication.
3. Engineering Chemistry –B.K.Sharma, Krishna Publication.
4. Engineering Chemistry –Jain & Jain
5. Engineering Chemistry- O.G.Palanna, McGraw Hill Education (India) Private Limited.
6. G.Zhong Cao. Nanostructures and Nanomaterials: Synthesis, Properties and Applications, Imperial College Press(2004)
7. M.Ratner and D. Ratner. Nanotechnology: A Gentle Introductionto the Next Big Idea, Pearson Education (2003)
8. J.Schulte, Nanotechnology: Global Strategies, Industry Trends and Applications.
9. J.Schulte, Nanotechnology: Global Strategies, Industry Trends and Applications.
10. G.Schmid, Nanotechnology, Volume1: Principles and Fundamentals.

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