

Reduced Syllabus

SEMESTER-V

CORE COURSE (HONOURS IN CHEMISTRY)

PAPER: CHE-H-C-511-T

ORGANIC CHEMISTRY-IV

Marks: 15 (MSE) + 60 (ESE) = 75

Pass Marks: (MSE: 06 + ESE: 24) = 30

Instruction to Question Setter for

Mid Semester Examination (MSE): $1\frac{1}{2}$ Hrs.

The Mid Semester Examination shall have two components. (a) One Semester Internal Assessment Test (SIA) of 10 Marks. There will be three questions of 5 marks each, out of which two are to be answered. Each question may be subdivided into two or more parts (b) Class Attendance Score (CAS) & Day to day activities (DDA) of 05 marks.

(Attendance: Upto 75% = 1 mark; 75-80% = 1.5 marks; 80.-85% = 2 marks; 85-90% = 2.5 marks; >90% = 3 marks)

End Semester Examination (ESE): 3 Hrs.

There will be two groups of questions. **Group A is compulsory** and will contain two questions. **Q. No. 1(A)** will be multiple type six questions of 1 mark each. **Q. No. 1(B)** will contain two short answer type questions (max. 50 words) each of 3 marks. **Group B will contain descriptive type eight questions** of twelve marks each, out of which any four are to be answered.

UNIT 1:

Nucleic Acids

Components of nucleic acids, Nucleosides and Nucleotides; Structure, synthesis and reactions of: Adenine, Uracil and Thymine; Structure of polynucleotides.

UNIT 2: Amino Acids, Peptides and Proteins Amino acids, Peptides and their classification.

α -Amino Acids - Synthesis, ionic properties and reactions. Zwitterions, pKa values, isoelectric point and electrophoresis; Study of peptides: determination of their primary

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structures-end group analysis, methods of peptide synthesis. Synthesis of peptides using N-protecting, C-protecting and C-activating groups

UNIT 3:

Pharmaceutical Compounds: Structure and Importance Classification, structure and therapeutic uses of antipyretics: Paracetamol (with synthesis), Analgesics: Ibuprofen (with synthesis), Antimalarial: Chloroquine (with synthesis). An elementary treatment of Antibiotics and detailed study of chloramphenicol, Medicinal values of curcumin (haldi), azadirachtin (neem), vitamin C and antacid (ranitidine).

Reference Books:

1. Berg, J.M., Tymoczko, J.L. and Stryer, L. (2006) Biochemistry. VIth Edition. W.H. Freeman and Co.
2. Nelson, D.L., Cox, M.M. and Lehninger, A.L. (2009) Principles of Biochemistry. IVEdition. W.H. Freeman and Co.
3. Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2009) Harper's Illustrated Biochemistry. XXVIII edition. Lange Medical Books/McGraw-Hill.

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SEMESTER-V
CORE COURSE (HONOURS IN CHEMISTRY)

PAPER: CHE-H-C-512-T
PHYSICAL CHEMISTRY-V

Marks: 15 (MSE) + 60 (ESE) = 75

Pass Marks: (MSE: 06 + ESE: 24) = 30

Instruction to Question Setter for

Mid Semester Examination (MSE): $1\frac{1}{2}$ Hrs.

The Mid Semester Examination shall have two components. (a) One Semester Internal Assessment Test (SIA) of 10 Marks. There will be three questions of 5 marks each, out of which two are to be answered. Each question may be subdivided into two or more parts (b) Class Attendance Score (CAS) & Day to day activities (DDA) of 05 marks.

(Attendance: Upto 75% = 1 mark; 75-80% = 1.5 marks; 80.-85% = 2 marks; 85-90% = 2.5 marks; >90% = 3 marks)

End Semester Examination (ESE): 3 Hrs.

There will be two groups of questions. **Group A is compulsory** and will contain two questions. **Q. No. 1(A)** will be multiple type six questions of 1 mark each. **Q. No. 1(B)** will contain two short answer type questions (max. 50 words) each of 3 marks. **Group B will contain descriptive type eight questions** of twelve marks each, out of which any four are to be answered.

UNIT 1:

Quantum Chemistry Postulates of quantum mechanics, quantum mechanical operators, Schrödinger equation and its application to free particle and "particle-in-a-box" (rigorous treatment), quantization of energy levels, zero-point energy and Heisenberg Uncertainty principle; wave functions, probability distribution functions.

UNIT 2: Molecular Spectroscopy Interaction of electromagnetic radiation with molecules and various types of spectra; Born- Oppenheimer approximation. Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution.

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Vibrational spectroscopy: Classical equation of vibration, computation of force constant, amplitude of diatomic molecular vibrations, anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration, concept of group frequencies.

Electronic spectroscopy: Franck-Condon principle, electronic transitions, singlet and triplet states, fluorescence and phosphorescence, dissociation and predissociation, calculation of electronic transitions of polyenes using free electron model.

UNIT3: Photochemistry Characteristics of electromagnetic radiation, Lambert-Beer's law and its limitations, physical significance of absorption coefficients. Laws, of photochemistry, quantum yield, actinometry, examples of low and high quantum yields, photochemical equilibrium and the differential rate of photochemical reactions, photosensitised reactions.

Reference Books:

1. Banwell, C. N. & McCash, E. M. Fundamentals of Molecular Spectroscopy 4th Ed. Tata McGraw-Hill: New Delhi(2006).
2. Chandra, A. K. Introductory Quantum Chemistry Tata McGraw-Hill(2001).
3. House, J. E. Fundamentals of Quantum Chemistry 2nd Ed. Elsevier: USA(2004).
4. Lowe, J. P. & Peterson, K. Quantum Chemistry, Academic Press(2005).
5. Kakkar, R. Atomic & Molecular Spectroscopy, Cambridge University Press(2015).

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SEMESTER - V

CORE COURSE (HONOURS IN CHEMISTRY) PAPER: CHE-H-C-511 & 512-P CHEMISTRY LAB (PRACTICAL)

Full Marks: 15 (MSE) + 60 (ESE) = 75

Pass Marks: (MSE: 06 + ESE: 24) = 30

Instruction to Question Setter for

Mid Semester Examination (MSE): 03 Hrs.

The Mid Semester Examination shall have one components: One Semester Internal Assessment Test (SIA). Distribution of Marks: Two experiments = 10 marks, Practical record/note book = 2.5 marks, Viva-voce = 2.5 marks

End Semester Examination (ESE): 03 Hrs.

Three experiments (questions) will be set (one from each group) each of 40 marks out of which one is to be answered. Evaluation of Practical Examination may be as per the following guidelines: Experiment = 40 marks Practical record notebook = 10 marks Viva-voce = 10 marks

GROUP "A"

PAPER: CHE-H-C-511-P

ORGANIC CHEMISTRY-IV LAB

1. Estimation of glycine by Sorenson's formalin method.
2. Study of the titration curve of glycine.
3. Estimation of proteins by Lowry's method.
4. Study of the action of salivary amylase on starch at optimum conditions.
5. Effect of temperature on the action of salivary amylase.

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GROUP "B"

PAPER: CHE-H-C-512-P

ORGANIC CHEMISTRY-IV LAB

UV/Visible spectroscopy

- I. Study the 200-500 nm absorbance spectra of KMnO_4 and $\text{K}_2\text{Cr}_2\text{O}_7$ (in 0.1 M H_2SO_4) and determine the λ_{max} values. Calculate the energies of the two transitions in different units (J molecule^{-1} , kJ mol^{-1} , cm^{-1} , eV).
- II. Study the pH-dependence of the UV-Vis spectrum (200-500 nm) of $\text{K}_2\text{Cr}_2\text{O}_7$.

Colourimetry

- I. Verify Lambert-Beer's law and determine the concentration of $\text{CuSO}_4/\text{KMnO}_4/\text{K}_2\text{Cr}_2\text{O}_7$ in a solution of unknown concentration
- II. Determine the concentrations of KMnO_4 and $\text{K}_2\text{Cr}_2\text{O}_7$ in a mixture.
- III. Study the kinetics of iodination of propanone in acidic medium.
- IV. Determine the amount of iron present in a sample using 1,10-phenanthroline.

Reference Books:

1. Manual of Biochemistry Workshop, 2012, Department of Chemistry, University of Delhi.
2. Arthur, I. V. Quantitative Organic Analysis, Pearson.
3. Khosla, B.D.; Garg, V.C. & Gulati, A., Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).
4. Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. Experiments in Physical Chemistry 8th Ed.; McGraw-Hill: New York (2003).
5. Halpern, A.M. & McBane, G.C. Experimental Physical Chemistry 3rd Ed.; W.H. Freeman & Co.: New York (2003).

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SEMESTER-V

(DSE-01A)

PAPER: CHE-H-DSE-501 A -T

ANALYTICAL METHODS IN CHEMISTRY

Marks: 15 (MSE) + 60 (ESE) = 75

Pass Marks: (MSE: 06 +ESE: 24) = 30

Instruction to Question Setter for

Mid Semester Examination (MSE): $1\frac{1}{2}$ Hrs.

The Mid Semester Examination shall have two components. (a) One Semester Internal Assessment Test (SIA) of 10 Marks. There will be three questions of 5 marks each, out of which two are to be answered. Each question may be subdivided into two or more parts (b) Class Attendance Score (CAS) & Day to day activities (DDA) of 05 marks.

(Attendance: Upto 75% = 1 mark; 75-80% = 1.5 marks; 80.-85% = 2 marks; 85-90% = 2.5 marks; >90% = 3 marks)

End Semester Examination (ESE): 3 Hrs.

There will be two groups of questions. **Group A is compulsory** and will contain two questions. **Q. No. 1(A)** will be multiple type six questions of 1 mark each. **Q. No. 1(B)** will contain two short answer type questions (max. 50 words) each of 3 marks. **Group B will contain descriptive type eight questions** of twelve marks each, out of which any four are to be answered.

Unit 1

Optical methods of analysis Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law. UV-Visible Spectrometry: Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instrument. Infrared Spectrometry: Basic principles of instrumentation (choice of source, monochromator & detector) for single and double beam instrument; sampling techniques.

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UNIT 2:

Thermal methods of analysis: Theory of thermo gravimetry (TG), basic principle of instrumentation. Techniques for quantitative estimation of Ca and Mg from their mixture.

UNIT 3:

Electro analytical method Classification of electro analytical methods, basic principle of pH metric, potentiometric and conductometric titrations. Techniques used for the determination of equivalence points. Techniques used for the determination of pKa values.

UNIT 4:

Separation techniques Solvent extraction: Classification, principle and efficiency of the technique. Mechanism of extraction: extraction by solvation and chelation.

Reference Books:

1. Vogel, Arthur I: A Test book of Quantitative Inorganic Analysis (Rev. by G.H. Jeffery and others) 5th Ed. The English Language Book Society of Longman.
2. Willard, Hobert H. et al.: Instrumental Methods of Analysis, 7th Ed. Wardsworth Publishing Company, Belmont, California, USA, 1988.
3. Christian, Gary D; Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004.
4. Harris, Daniel C: Exploring Chemical Analysis, Ed. New York, W.H. Freeman, 2001.
5. Khopkar, S.M. Basic Concepts of Analytical Chemistry. New Age, International Publisher, 2009.
6. Skoog, D.A. Holler F.J. and Nieman, T.A. Principles of Instrumental Analysis, Thomson Asia Pvt. Ltd. Singapore.

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SEMESTER-V

(DSE-01A:PRACTICAL)

PAPER: CHE-H-DSE-501A-P

PRACTICALS- DSE LAB

ANALYTICAL METHODS IN CHEMISTRY

I. Separation Techniques

1. Chromatography:

(a) Separation of mixtures

(i) Paper chromatographic separation of Fe^{3+} , Al^{3+} , and Cr^{3+} .

(ii) Separation and identification of the monosaccharides present in the given mixture (glucose & fructose) by paper chromatography. Reporting the R_f values.

(b) Separate a mixture of Sudan yellow and Sudan Red by TLC technique and identify them on the basis of their R_f values.

II Solvent Extractions:

(i) To separate a mixture of Ni^{2+} & Fe^{2+} by complexation with DMG and extracting the Ni^{2+} -DMG complex in chloroform, and determine its concentration by spectrophotometry.

(ii) Solvent extraction of zirconium with amberlite LA-1, separation from a mixture of iron and gallium.

(iii). Determine the pH of the given aerated drinks fruit juices, shampoos and soaps.

(iv). Analysis of soil:

(i) Determination of pH of soil.

(ii) Total soluble salt

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(iii) Estimation of calcium, magnesium, phosphate, nitrate

(v). Ion exchange:

(i) Determination of exchange capacity of cation exchange resins and anion exchange resins.

(ii) Separation of metal ions from their binary mixture.

III Spectrophotometry

1. Determination of pKa values of indicator using spectrophotometry. 2. Structural characterization of compounds by infrared spectroscopy. 3. Determination of dissolved oxygen in water.

Reference Books:

- 1 Vogel, Arthur I: A Text book of Quantitative Inorganic Analysis (Rev. by G.H. Jeffery and others) 5th Ed. The English Language Book Society of Longman.
2. Willard, Hobert H. et al.: Instrumental Methods of Analysis, 7th Ed. Wardsworth Publishing Company, Belmont, California, USA, 1988.
3. Christian, Gary D; Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004.
4. Harris, Daniel C: Exploring Chemical Analysis, Ed. New York, W.H. Freeman, 2001.
5. Khopkar, S.M. Basic Concepts of Analytical Chemistry. New Age, International Publisher, 2009.

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Reduced Syllabus

SEMESTER V

COURSE (CHEMISTRY GENERAL) for other Departments/Disciplines.

PAPER: CHE-G-DSE-501A-T

Marks: 15 (MSE) + 60 (ESE) = 75

Pass Marks: (MSE: 06 + ESE: 24) = 30

Instruction to Question Setter for

Mid Semester Examination (MSE): $1\frac{1}{2}$ Hrs.

The Mid Semester Examination shall have two components. (a) One Semester Internal Assessment Test (SIA) of 10 Marks. There will be three questions of 5 marks each, out of which two are to be answered. Each question may be subdivided into two or more parts (b) Class Attendance Score (CAS) & Day to day activities (DDA) of 05 marks.

End Semester Examination (ESE): 3 Hrs.

There will be two groups of questions. **Group A is compulsory** and will contain two questions. **Q. No. 1(A)** will be multiple type six questions of 1 mark each. **Q. No. 1(B)** will contain two short answer type questions (max. 50 words) each of 3 marks. **Group B will contain descriptive type eight questions** of twelve marks each, out of which any four are to be answered.

PAPER: CHE-G-DSE-501A-T

GENERAL-V INDUSTRIAL CHEMICALS AND ENVIRONMENT

Unit 1

Industrial Gases and Inorganic Chemicals Industrial Gases: Large scale production, uses, storage and hazards in handling of the following gases: argon, helium, hydrogen, acetylene, sulphur dioxide and phosgene. Inorganic Chemicals: Manufacture, application, analysis and hazards in handling the following chemicals: hydrochloric acid, nitric acid, sulphuric acid, caustic soda, common salt, borax, bleaching powder.

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Unit 2

Environment and its segments

Ecosystems. Biogeochemical cycles of carbon, nitrogen and sulphur. Air Pollution: Major regions of atmosphere. Chemical and photochemical reactions in atmosphere. Air pollutants: types, sources, particle size and chemical nature; Photochemical smog: its constituents and photochemistry. Environmental effects of ozone, Major sources of air pollution. Pollution by SO_2 , CO_2 , CO , NO_x , H_2S and other foul smelling gases. Methods of estimation of CO , NO_x , SO_x and control procedures. Effects of air pollution on living organisms and vegetation. Greenhouse effect and Global warming, Ozone depletion by oxides of nitrogen, chlorofluorocarbons and Halogens, removal of sulphur from coal. Control of particulates.

Unit 3

Energy & Environment Sources of energy: Coal, petrol and natural gas. Nuclear Fusion / Fission, Solar energy, Hydrogen, geothermal, Tidal and Hydel, etc. Nuclear Pollution: Disposal of nuclear waste, nuclear disaster and its management.

Unit 4

Biocatalysis Introduction to biocatalysis: Importance in "Green Chemistry" and Chemical Industry.

Reference Books:

1. E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK.
2. R.M. Felder, R.W. Rousseau: Elementary Principles of Chemical Processes, Wiley Publishers, New Delhi.
3. J. A. Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi.
4. S. S. Dara: A Textbook of Engineering Chemistry, S. Chand & Company Ltd. New Delhi.
5. K. De, Environmental Chemistry: New Age International Pvt., Ltd, New Delhi.
6. S. M. Khopkar, Environmental Pollution Analysis: Wiley Eastern Ltd, New Delhi.
7. S.E. Manahan, Environmental Chemistry, CRC Press (2005). G.T. Miller, Environmental Science 11th edition. Brooks/ Cole (2006).

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COURSE (CHEMISTRY GE) for other Departments/Disciplines.

PAPER: CHE-G-DSC-501A-P

Full Marks: 05 (MSE) + 20 (ESE) = 25

Pass Marks: (MSE: 02 + ESE: 08) = 10

Instruction to Question Setter for

1. Mid Semester Examination (MSE): 1.5 Hrs.

There will be two questions, out of which one is to be answered.

2. End Semester Examination (ESE): 3 Hrs.

There will be two groups of questions. Group A will contain two questions out of which one is to be answered for 12 marks. Group B will contain marks for NOTE

BOOK and VIVA VOCE each of 04 marks.

PAPER: CHE-G-DSC-501A-P

INDUSTRIAL CHEMICALS & ENVIRONMENT

1. Determination of dissolved oxygen in water.
2. Determination of Chemical Oxygen Demand (COD)
3. Percentage of available chlorine in bleaching powder.
4. Measurement of chloride, sulphate and salinity of water samples by simple titration method (AgNO_3 and potassium chromate).
5. Estimation of total alkalinity of water samples (CO_3^{2-} , HCO_3^-) using double titration method.

Reference Books:

1. E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK.
2. R.M. Felder, R.W. Rousseau: Elementary Principles of Chemical Processes, Wiley Publishers, New Delhi.
3. J. A. Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi.

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