MATA GUJRI COLLEGE

FATEHGARH SAHIB

(An Autonomous College)

B.Sc. Non-Medical/Medical

PROGRAMME CODE: BSNM/BSM

(Academic Session: 2022-2023)

PROGRAMME BROCHURE

(As approved by Academic Council)

FACULTY OF SCIENCES

P. G. DEPARTMENT OF CHEMISTRY

B.Sc. Non-Medical/Medical Revised syllabus as per UGC guidelines under CBCS
(Choice Based Credit System)

Prof. (Dr.) Baljit Singh
Prof. (Dr.) Sonal Singhal
Mr. Ravinderjeet Singh
Ms. Rachna Bhardwaj
Dr. Ajay Sharma
Mr. Puneet Bhardwaj
Mrs. Priya Sharma

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B.Sc. – III (Non-Medical/ Medical)

SEMESTER-V

Course	Course Code	Course Name	L T P (Credits)	No. of Lectures	Max . Marks (External+ Internal)
DSE-I	**BDSE(P)-501(i)/ BDSE(P)-501(ii)**	**Digital-Analog Circuits and Condensed Matter Physics Or Solid State Physics and Electronics Devices**	4 0 0 (4)	60	100 (75+25)
DSE-I Practical	**BDSE(P)-501(i)(P)/ BDSE(P)-501(ii)(P)**	**Physics Lab**	0 0 2 (2)	60	50
DSE-II	**BSNM/BSM (DSE)502(i)/ BSNM/BSM (DSE) 502(ii)/ BSNM/BSM 502(iii)/ BDSE(CP)-502**	**BSNM/BSM(DSE) 502(i): Organic Chemistry or BSNM/BSM(DSE) 502(ii): Inorganic Chemistry-I or BSNM/BSM(DSE) 502(iii): Chemistry of Inorganic Materials** **BDSE(CP)-502 Operating System**	4 0 0 (4)	60	100 (75+25)
DSE-II Practical	**BSNM/BSM ((DSE)) 502(i)(P)/ BSNM/BSM (DSE) 502(ii)(P)/ BSNM/BSM (DSE)502(iii) (P) / BSNM/BSM (DSE) 502 (iii) (P)**	**BSNM/BSM(DSE) 502(i)(P): Organic Chemistry Lab or BSNM/BSM(DSE) 502(ii)(P): Inorganic Chemistry Lab-I or BSNM/BSM(DSE) 502(iii)(P): Chemistry Lab: Chemistry of Inorganic Materials Lab** **BDSE(CP)-502(P) Software Lab based on Linux Operating System**	0 0 2 (2)	60	50

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DSE-III	**BDSE(M)-503(i)/ BDSE(M)-503(ii)**	**BDSE(M) 503(i):Geometry and Vector calculus Or BDSE(M) 503(ii):Metric Spaces**	5 1 0 (6)	90	100 (75+25)
SEC III	**BSEC(P)-504/ BSEC(C)-504/ BSEC(M)-504/ BSEC(CP)-504**	**BSEC(P)-504 Basic Instrumentation Skills**	0 0 2 (2)	30	50
		BSEC(C)-504 Pesticide Chemistry	0 0 2 (2)	30	50
		BSEC(M)-504(i)Vector Spaces Or BSEC(M)-504(ii)Laplace Transform & Its Applications	2 0 0 (2)	30	50 (40+10)
		BSEC(CP)-504 Object Oriented Programming using C++	0 0 2 (2)	30	50
AECC-VIII	**BAECC-505/BAECC-505A**	**Punjabi/Basic Punjabi**	5 0 0 (5)	60	100 (75+25)
			Total Credits:25		**Total Marks:550**

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SEMESTER-VI

Course	Course Code	Course Name	L T P (Credits)	No. of Lectures	Max. Marks (External + Internal)
DSE-IV	**BDSE(P)-601(i)/ BDSE(P)-601(ii)**	**BDSE(P)-601(i): Nuclear & Particle Physics Or BDSE(P)-601(ii): Radiation Physics**	4 0 0 (4)	60	100 (75+25)
DSE-IV Practical	**BDSE(P)-601(i)(P)/ BDSE(P)-601(ii)(P)**	**Physics Lab**	0 0 2 (2)	60	50
DSE-V	**BSNM/BSM (DSE)-602(i)/ BSNM/BSM-602(ii)/ BSNM/BSM (DSE) 602(iii)/ BDSE(CP)-602**	**BSNM/BSM (DSE) 602(i): Physical Chemistry Or BSNM/BSM (DSE) 602(ii): Inorganic Chemistry-II Or BSNM/BSM (DSE) 602(iii): Analytical Methods in Chemistry** **BDSE(CP)-602 Software Engineering**	4 0 0 (4)	60	100 (75+25)
DSE-V Practical	**BSNM/BSM (DSE)-602(i)(P)/ BSNM/BSM (DSE)-602(ii)(P)/ BSNM/BSM (DSE)-602(iii)(P)/ BDSE(CP)-602(P)**	**BSNM/BSM (DSE) 602(i)(P): Physical Chemistry Lab Or BSNM/BSM (DSE) 602(ii)(P): Inorganic Chemistry Lab-II Or BSNM/BSM (DSE) 602(iii)(P) Lab: Analytical Methods in Chemistry**	0 0 2 (2)	60	50

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		BDSE(CP)-602(P) Lab based on Software Engineering			
DSE-VI	**BDSE(M)-603**	**BDSE(M) 603(i): Integral Calculus** **Or** **BDSE(M) 603(ii): Partial Differential Equations & its Applications**	5 1 0 (6)	90	100 (75+25)
SEC-VI	**BSEC(P)-604/ BSEC(C)-604/ BSEC(M)-604/ BSEC(CP)-604**	**BSEC(P) 604 Radiation Safety**	0 0 2 (2)	30	50
		BSEC(C) 604 Pharmaceutical Chemistry	0 0 2 (2)	30	50
		BSEC(M) 604 (i) Some Special Functions **BSEC(M) 604 (ii)Fourier Integral & Fourier Transforms**	2 0 0 (2)	30	50 (40+10)
		BSEC(CP) 604 Visual Programming	0 0 2 (2)	30	50
AECC-IX	**BAECC-605/ BAEC-605A**	**Punjabi/Basic Punjabi**	5 0 0 (5)	60	100 (75+25)
			Total Credits:25		**Total Marks:550**

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B.Sc. (Non-Medical/ Medical)-III

SEMESTER-V

BSNM/BSM(DSE)-502(i): Organic Chemistry

(Common for B.Sc. Medical and Non-Medical)

No. of Lectures: 60

L T P

4 0 0

Maximum Marks: 100

(i) External Examination: 75 Time: 3 hrs.

(ii) Internal Assessment: 25 Pass Marks: 35%

Course Objectives

- To get a deep insight into the various spectroscopic methods used for the characterisation of organic compounds.
- Enable the students to elucidate the structure of organic compounds by analysing the spectral data.
- To make students understand the various heterocyclic compounds, their properties, structure, reactivity and reactions.
- To describe organic synthesis via enolates.

Course Outcomes

On the completion of this course, students will be able to:

CO1: Name heterocycles and understand the criteria of aromaticity and resonance in heterocycles

CO2: List the synthetic methods and reactions of important five and six membered heterocycles and fused heterocycles.

CO3: Explain the basic principles of the following spectroscopic techniques: UV/Vis, IR, and proton NMR spectroscopy.

CO4: Explain how the above-named techniques can be used to distinguish and identify simple organic compounds.

CO5: Solve problems concerning the elucidation of the structure of simple organic compounds.
CO6: Learn about the acidity of ∝-Hydrogens in acetoacetic ester and malonic ester and predict various substituted products starting from acetoacetic ester and malonic

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INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three units: unit I, unit II and unit III. Unit I and II will have four questions from respective units of the syllabus and will carry 12 marks each. Unit III will consist of nine questions from the whole syllabus and will carry 3 marks each.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt two questions each from Unit I & Unit II. Unit III is compulsory.

Note: Internal assessment will be given on the basis of mid semester tests (12.5), Attendance (5), General Conduct (2.5), Assignments/Quiz/Seminar (5).

Unit-I

UV-Visible Spectroscopy (9 Lectures)

Absorption spectra: Ultraviolet (UV) absorption spectroscopy-absorption laws (Beer-Lambert's law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation, concept of chromophore and auxochrome, bathochromic, hyperchromic and hypsochromic shifts, UV spectra of conjugated enes and enones, Woodward-Fieser rules for calculation of λ_{max}. Applications of UV spectroscopy.

Infrared (IR) Absorption Spectroscopy (8 Lectures)

Molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds. Applications of IR spectroscopy.

Nuclear Magnetic Resonance (NMR) Spectroscopy (13 Lectures)

Proton magnetic resonance (PMR) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constants, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromoethane, ethyl acetate, toluene and acetophenone.

Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and PMR spectroscopic techniques.

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Unit-II

Heterocyclic-I **(14 Lectures)**

Introduction: Molecular orbital picture of pyrrole, furan, thiophene, pyridine. Classification, Nomenclature, structure and aromaticity in 5 and 6 membered rings containing heteroatom. Methods of synthesis of Furan (Paal Knorr synthesis, Feist-Benary synthesis) Pyrrole (Paal Knorr synthesis, Hantzsch pyrrole synthesis), thiophene (Paal Knorr synthesis, from acetylene), pyridine (Hantzsch synthesis of Pyridine derivatives), reactions and mechanism of electrophilic substitution of Furan, Pyrrole and Thiophene, Electrophilic and Nucleophilic substitution reactions of Pyridine, Mechanism and orientation of Electrophilic and Nucleophilic substitution reactions of Pyridine Basicity of Pyridine, comparison of basicity of pyridine, piperidine and pyrrole.

Heterocyclic-II **(10 Lectures)**

Condensed Five and six membered Heterocyclic compounds: Indole (Fischer indole synthesis, Madelung synthesis, Reissert synthesis, Quinoline (Skraup synthesis, Doebner-Miller synthesis), Isoquinoline (Bischer-Napieralski synthesis, Pomeranz-Fritsch synthesis), Basicity, electrophilic and nucleophilic substitution reactions of Indole, Quinoline and Isoquinoline.

Organic Synthesis via Enolates **(6 Lectures)**

Acidity of α-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate: Claisen Condensation. Keto-enol tautomerism of ethyl acetoacetate.

Teaching-learning Activities

- Seminar presentation
- Assignments
- Quiz
- Group tutorial work

Books Recommended:

1. W. Kemp, Organic Spectroscopy, UK.
2. J. Mohan, Organic Spectroscopy: Principles and Applications, 2001.
3. D.L. Pavia, G.M. Lampan and G.S. Kriz, Introduction to Spectroscopy, Hartcourt College Publishers.
4. Y.R. Sharma, Organic Spectroscopy, 2015.
5. R.M. Silverstein, G.C. Bassler and F.C Morill, Spectrometric Identification of Organic Compounds; 5th Edition, John Wiley and Sons Inc.

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6. R.T. Morrison, R.N. Boyd and S.K. Bhattacharjee, Organic Chemistry, 4th Ed., 2010.
7. R.T Morrison and R.N Boyd, Organic Chemistry dorling Kindersley (India) pvt. Ltd. (Pearson Education).
8. J.A. Joule and K. Mills, Heterocyclic Chemistry, 4th Ed.
9. T. L. Gilchrist Hetrocyclic Chemistry 3rd Ed.
10. S.P. Singh, R.P. Kapoor, S.M. Mukherji, R. Dass, Organic Chemistry, Volume 2.

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B.Sc. Non-Medical/Medical-III

SEMESTER-V

BSNM/BSM(DSE)-502(i) (P): Organic Chemistry Practical

(Common for B.Sc. Medical and Non-medical)

Maximum Marks: 50 **No. of Lectures: 60**

Time allowed: 4 hrs

Course Objectives

- To carry out preparation of organic compounds and derivatives of organic functional groups
- To impart the knowledge about the characterisation of organic compounds with the help of UV-Vis and IR spectroscopic techniques.

Course Outcomes

On the completion of this course, the students will be able to:

CO1: Handle sophisticated instruments/equipment (UV and IR-Spectro-photometer).

CO2: Synthesize organic compounds

CO3: Characterize organic compounds through their derivative formation and with the help of UV-Vis and IR Spectroscopy

Instructions: examination will be conducted in one single day and marks distribution will be as follows:

Notebook: 5 marks

Viva Voce: 10 marks

Write-up and Performance: 25 marks

Project report: 10 marks

1. **Organic Chemistry:** Preparation of derivatives of compounds having functional groups: (phenolic, carboxylic, esters, carbohydrates, amines, amides, nitro and anilide) and characterization of a few derivatives with the help of UV-Vis and IR spectroscopy.
2. To prepare Schiff base and its characterization with the help of UV-Vis and IR spectroscopy.
3. Preparation of nitrobenzene from benzene
4. Preparation of 2-phenylindole from phenyl hydrazine.

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5. Preparation of methyl orange involving diazotization and coupling
6. Preparation of benzoic acid from toluene by oxidation process.
7. Preparation of acetanilide from aniline.
8. Preparation of benzimidazole.
9. Preparation of benzene Azo-$\boldsymbol{\beta}$-naphthol from Aniline
10. Preparation of meta- nitroaniline by reduction method

Books Recommended:

1. Textbook on Practical Chemistry by Dr. K.S. Makherjee, new central book agency(P) Ltd. London
2. Advanced Practical Chemistry by R. Mukhopadhyay and P.Chatterjee
3. Advanced Practical Chemistry by Jagdamba Singh, R.K.P. Singh, Jaya Singh, L.D.S. Yadav, I.R. Siddiqui, Jaya Shrivastava, Pragati Prakashan
4. Vogel's Textbook of Practical Organic Chemistry, 5th Edition ELBS (Longman), 1996.
5. Practical Organic Chemistry, F.G. Mann and B.C. Saunders, 5th Edition, Orient Longman Limited, 1986.

PROJECT **(10Marks)**

Students are required to carry out a project and prepare project reports. They can select from the below mentioned projects or carry out any other project of their choice.

Suggested Projects:

- Study of pH-dependence of the UV-Vis spectrum (200-800 nm) of $K_2Cr_2O_7$.
- Effect of structure on UV spectra of the given compounds (acetone, acetaldehyde,2-propanol, acetic acid) in water.
- Identification of simple organic compounds by IR spectroscopy and NMRs
- Study of the kinetics of interaction of crystal violet/phenolphthalein with sodium hydroxide.
- Study of the kinetics of iodination of propanone in acidic medium.
- Build and minimize organic compounds of your choice containing different functional groups. Note the dipole moment of each compound: (a) alkyl halide (b)aldehyde (c) ketone (d) amine (e) ether (f) nitrile (g) thiol (h) carboxylic acid (i) ester(j) amide.
- Compare the optimized C-C bond lengths in ethane, ethene, ethyne and benzene.

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- Perform a conformational analysis of butane (b) Determine the enthalpy of isomerization of *cis*- and *trans*-2-butene.
- Arrange 1-hexene, 2-methyl-2-pentene, (*E*)-3-methyl-2-pentene, (*Z*)-3-methyl-2-pentene, and 2,3-dimethyl-2-butene in order of increasing stability.
- IR studies of Heterocyclic compounds
- Development of biodegradable polymers.

Note: Software: ChemSketch, ChemDraw, ArgusLab (www.planaria-software.com), TINKER 6.2(dasher.wustl.edu/ffe), WebLab Viewer, Hyperchem, or any similar software.

Teaching-learning Activities

- Hands on Training
- Viva Voce interview

B.Sc. (Non-Medical/ Medical) III

SEMESTER-V

BSNM/BSM (DSE)-502(ii): Inorganic Chemistry-I

(Common for B.Sc. Medical and Non-Medical)

Maximum Marks: 100 **No. of Lectures: 60**

(i) External Examination: 75 **Time: 3 Hrs.**

(ii) Internal Assessment: 25 **Pass Marks: 35%**

Course Objectives

- To understand chemistry of organometallic compounds, metal olefins complexes and metal carbonyls.
- To improve the level of understanding of chemistry of organometallic compounds.
- To understand the general concept of reaction kinetics and mechanism of octahedral complexes and applying Trans effect in predicting substitution products in square planar complexes.
- To understand the role of metal ions in biological systems
- To give knowledge about oxidation and reduction reactions

Course Outcomes

On the completion of this course, the students will be able to:

CO1: Relate the concepts of organometallic chemistry in various organometallic reactions.

CO2: Correlate the industrially important catalytic processes through the application of organometallic principles.

CO3: Analyse the factors affecting the stability of complexes and predict thermodynamic and kinetic stability of complexes.

CO4: Identify and interpret the mechanisms of substitution reactions in octahedral complexes.

CO5: To predict formation of different substitution products in square planar complexes

CO6: Interpret the role of metal ions in biological systems.

CO7: To understand thermodynamics of reduction processes and apply principles of oxidation and reduction in extraction of metal ions

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INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three units: unit I, unit II and unit III. Unit I and II will have 4 questions from respective unit of the syllabus and will carry 12 marks each. Unit III will consist of 9 questions from the whole syllabus and will carry 3 marks each.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt 2 questions from each Unit I & Unit II. Unit III is compulsory.

Note: Internal Assessment will be given on the basis of semester tests, class performance, attendance and assignment/quiz.

Unit-I

Organometallic Chemistry (12 Lectures)

Definition and types of organometallic compounds, Hapticity of ligands, classification of ligands, Effective atomic number rule, 18 Electron Rule, Electron count in complexes by Neutral atom method and Oxidation state method. Nomenclature of organometallic compounds, bonding in organometallic compounds; preparation, properties, bonding and applications of organoaluminium, organotin compounds. Laboratory method of preparation of Ferrocene and its chemical properties.

Metal Olefin Complexes (10 Lectures)

Metal ethylene complexes, bonding in metal olefin complexes

Catalysis by Organometallic Compounds

Study of the following industrial processes and their mechanisms: 1. Alkene hydrogenation (Wilkinson's Catalyst) 2. Hydroformylation (Co salts) 3. Wacker Process 4. Ziegler-Natta catalyst.

Metal Carbonyls (8 Lectures)

Preparation, properties, structure of the mononuclear, binuclear, trinuclear and tetranuclear carbonyls. Acceptor behaviour of CO. Bonding in metal carbonyls, Spectroscopic studies of carbonyls.

Unit-II

Oxidation and Reduction (9 Lectures)

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Analysis of redox cycle, Redox Stability in water, Disproportionation reactions, Latimer Diagrams, Frost (Oxidation State) diagrams, Pourbaix diagrams, Occurrence and Extraction of the elements and Thermodynamics of Reduction Processes and Ellingham diagrams.

Reaction Kinetics and Mechanism (10 Lectures)

Thermodynamic and kinetic stability of complexes, labile and inert complexes, interpretation of lability and inertness of complexes. kinetics of substitution reactions in square planar complexes, the trans effect with theories.

Bioinorganic Chemistry (11 Lectures)

Metal ions present in the biological system: classification of elements according to their action in biological systems, Metalloporphyrin with special reference to Haemoglobin and Myoglobin, Physiology of Haemoglobin and Myoglobin, Bohr's Effect, Sodium/Potassium pump, biological importance of Na^+, K^+, Mg^{2+} and Ca^{2+}. Metalloenzyme with special reference to carboxypeptidase-A, Nitrogen fixation, toxicity of metal ions (Hg^{2+}, Pb^{2+}, As^{2+}), reasons for toxicity, Role of metal ions in biology (Cu^{2+}, Co^{2+}, Zn^{2+})

Teaching-learning Activities

- Seminar presentation
- Assignments
- Quiz
- Group tutorial work

Books recommended:

1. J. D. Lee, Concise Inorganic chemistry, ELBS.
2. F. A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, Wiley, VCH, 1999.
3. B. R. Puri, L.R. Sharma and K. C. Kalia, Principle of Inorganic chemistry, Milestone Publishers, Delhi.
4. J. E. Huheey, Inorganic Chemistry, Prentice Hall.
5. P. Atkins, Physical Chemistry, 1978.
6. A. Elias and B.D. Gupta, Basic Organometallic Chemistry, 2013.

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B.Sc. (Non-Medical/ Medical)-III

SEMESTER-V

BSNM/BSM (DSE)-502(ii)(P): Inorganic Chemistry Practical-I

(Common for B.Sc. Medical and Non-Medical)

Maximum Marks: 50 No. of Lectures: 60

Time allowed: 4 Hrs

Course Objectives

- To impart the knowledge of methods of preparation of coordination complexes.
- To learn the estimation of metal ions in complexes
- To find out stoichiometry of complexes

Course Outcomes

On the completion of the course, the students will be able to:

CO1: Perform synthesis of simple coordination compounds.

CO2: Estimate metal ion present in the complexes

CO3: Determine stoichiometry of the metal-ligand complexes by Job method

Instructions: Practical examination will be conducted in one single day and marks distribution will be as follows:

Notebook: 5 marks

Viva Voce: 10 marks

Write-up and Performance: 25 marks

Project report: 10 Marks

1. Preparation of potassium trioxalotoferrate (III) and determine its composition by permagnatometry
2. Preparation of trisoxalotoaluminate
3. Preparation of tetramminecopper sulphate complex
4. Preparation of cis and trans-bisoxalatodiaquachromate (III) ion
5. Preparation of hexaaminecobalt (III).
6. Determination of stoichiometry by Job's Method.
7. To prepare nickel dimethylglyoxime
8. Preparation of cis and trans potassium dioxalatodiaquochromate(III)

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9. Estimation of Mg^{2+} by using chlorophyll.

PROJECT (10 Marks)

Students are required to carry out a project and prepare project reports. They can select from the below mentioned projects or carry out any other project of their choice.

- Determination of 10Dq values and verification of ligands in spectrochemical series (ox, NH_3, water).
- Controlled synthesis of two copper oxalate hydrate complexes: kinetic vs. thermodynamic factors.
- Preparation of acetylacetonato complexes of Cu^{2+}/Fe^{3+}. Find the λ_{max} of the complexes.
- Synthesis of ammine complexes of Ni(II) and its ligand exchange reactions (e.g. bidentate ligands like acetylacetone, DMG, glycine) by substitution method.
- Calculate single point energy and optimise the geometry of compounds in molecular modelling software.
- Transition metal complexes as catalysts.
- Study of the action of salivary amylase on starch at optimal conditions.
- Effect of temperature on the action of salivary amylase.

Note: **Software: ChemSketch, Chemdraw, ArgusLab (www.planaria-software.com), TINKER 6.2(dasher.wustl.edu/ffe), WebLab Viewer, Hyperchem, or any similar software.**

Teaching-learning Activities

- Hands on Training
- Viva Voce interview

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Mr. Puneet Bhardwaj
Mrs. Priya Sharma

Dr. Kamalpreet Kaur
Ms. Simrat Kaur
Dr. Kiran
Dr. Kuldeep Kaur
Ms. Seema Maheshwari
Dr. Amritpal Singh
Dr. Manpreet Kaur

B.Sc. (Non-Medical/ Medical) III
SEMESTER-V
BSNM/BSM (DSE)-502(iii): CHEMISTRY OF INORGANIC MATERIALS
(Common for B.Sc. Medical and Non-Medical)

Maximum Marks: 100 L T P 4 0 0
No. of Lectures: 60
(i) External Examination: 75 Time: 3 hrs.
(ii) Internal Assessment: 25 Pass Marks: 35%

Course Objectives

- To introduce the students about an emerging field of novel inorganic solids and its fascinating aspects.
- To provide a comprehensive overview of the synthesis of nanomaterials and inorganic solids.
- To provide a fundamental knowledge of the polymers & composite materials and their chemical, physical and mechanical behaviour.

Course Outcomes

On the completion of this course, students will be able to:

CO1: Develop important processing skills of engineering materials which will enhance lifelong learning.

CO2: synthesise the nanoparticles specifically gold and silver NPs.

CO3: familiar with the different methods used for the solid-state synthesis.

CO4: Learn the use of various engineering materials along with their properties in mechanical constructions.

CO5: explain the advantages of the use of composite material over conventional engineering material.

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three units: unit I, unit II and unit III .Unit I and II will have 4 questions from respective unit of the syllabus and will carry 12 marks each. Unit III will consist of 9 questions from the whole syllabus and will carry 3 marks each.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt 2 questions from each Unit I & Unit II. Unit III is compulsory.

Prof. (Dr.) Baljit Singh
Prof. (Dr.) Sonal Singhal
Mr. Ravinderjeet Singh
Ms. Rachna Bhardwaj
Dr. Ajay Sharma
Mr. Puneet Bhardwaj
Mrs. Priya Sharma
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Ms. Simrat Kaur
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Note: Internal Assessment will be given on the basis of semester tests, class performance, attendance and assignment/quiz.

Unit-I

Synthesis and Modification of Inorganic Solids (10 Lectures)

Conventional heat and beat methods, Co-precipitation method, Sol-gel methods, Hydrothermal method, Ion-exchange and Intercalation methods. Solid electrolytes–Cationic, anionic, mixed Inorganic pigments – coloured solids, white and black pigments.

Molecular Materials (10 Lectures)

Molecular material and fullerides, molecular materials & chemistry – one dimensional metals, molecular magnets and inorganic liquid crystals.

Nanomaterials (10 Lectures)

Overview of nanostructures and nanomaterials: classification. Preparation of gold and silver metallic nanoparticles, self-assembled nanostructures control of nanoarchitecture one dimensional control. Carbon nanotubes and inorganic nanowires. Bio-inorganic nanomaterials, DNA and nanomaterials, natural and antisical nanomaterials, bionanocomposites.

Unit-II

Introduction to Engineering Materials for Mechanical Construction (10 Lectures)

Composition, mechanical and fabricating characteristics and applications of various types of cast irons, plain carbon and alloy steels, copper, aluminium and their alloys like duralumin, brasses and bronzes cutting tool materials, super alloys thermoplastics, thermosets and composite materials.

Composite Materials (10 Lectures)

Introduction, limitations of conventional engineering materials, role of matrix in composites, classification, matrix materials, reinforcements, metal-matrix composites, polymer-matrix composites, fibre-reinforced composites, environmental effects on composites, applications of composites.

Speciality Polymers (10 Lectures)

Conducting polymers-Introduction, conduction mechanism, polyacetylene, polyparaphenylene and polypyrrole, applications of conducting polymers, Ionexchange resins and their applications. Ceramic & Refractory: Introduction, classification, properties, raw materials, manufacturing and applications.

Teaching-learning Activities:

- Assignments
- Seminar presentation
- Group tutorial work

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Ms. Seema Maheshwari
Dr. Amritpal Singh
Dr. Manpreet Kaur

- Use of e-learning resources and self-study materials

Books recommended:

1. T. Overton, J. Rourke, M. Weller and F. Armstrong and P. Atkins, Inorganic Chemistry, 5th Edition, Oxford University Press (2011-2012).
2. D. M. Adam, Inorganic Solids: An introduction to concepts in solid-state structural chemistry. John Wiley & Sons, 1974.
3. C. P. Poole and F. J. Owens, Introduction to Nanotechnology John Wiley & Sons, 2003.
4. G. E. Rodger, Inorganic and Solid-State Chemistry, Cengage Learning India Edition, 2000.

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B.Sc. Non-Medical III
SEMESTER-V
BSNM/BSM (DSE)-502(iii) (P): CHEMISTRY OF INORGANIC MATERIALS
(Common for B.Sc. Medical and Non-Medical)

Maximum Marks: 50 No. of Lectures: 60
Time allowed: 4 Hrs.

Course Objectives

- To impart the knowledge of methods of synthesis, characterisation of nanomaterials and also learn to determine the cation via cation exchange method.

Course Outcomes

On the completion of this course, students will be able to:

CO1: Understand of top-down and bottom-up methods of nanomaterials preparation.

CO2: Knowledge of tools behind nanomaterial's characterisation.

CO3: Approaches to development of chemical and biological sensors based on plasmonics, spintronics, nano porosity and issues related to their translation from the research laboratory to the clinic and to point-of-care applications.

Instructions: Practical examination will be conducted in one single day and marks distribution will be as follows:

Notebook: 5 marks

Viva: 10 marks

Write-up and Performance: 25 marks

Project report: 10 Marks

1. Determination of cation exchange method
2. Determination of total difference of solids.
3. Synthesis of hydrogel by co-precipitation method.
4. Synthesis of metal nanoparticles (any four).
5. Minor research project related to chemistry

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PROJECT **(10Marks)**

Solid Phase extraction of caffeine from tea leaves.

Solid phase extraction of bioactive compounds from plants.

Find fluorescence quantum yield of a fluorescent dye.

Teaching-learning Activities

- Hands on Training
- Viva Voce interview

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B.Sc. Non-Medical III
SEMESTER-V

BSEC(C)-504 PESTICIDE CHEMISTRY
(Common for B.Sc. Medical and Non-Medical)

Maximum Marks: 50 No. of Lectures: 30
(Credits: 02)

Course Objectives

- To provide the complete knowledge of pesticides and their application in which delivery of pesticides, fungicides, insecticides to their biological target.

Course Outcomes

On the completion of this course, students will be able to:

CO1: Explain the various pesticides, insecticides, fungicides and herbicides.

CO2: Analyze the harmful effects of various pesticides and the amount of pesticide /insecticide suitable for enhancing the crop productivity.

General Introduction to Pesticide

Natural and synthetic, benefits and adverse effects, changing concepts of pesticides, structure activity relationship, synthesis and technical manufacture and uses of representative pesticides in the following classes: Organochlorines (DDT, Gammexane,) Organophosphates (Malathion, Parathion), Carbamates (Carbofuran and carbaryl) Quinones (Chloranil), Anilides (Alachlor and Butachlor).

Practicals

1. To calculate acidity/alkalinity in a given sample of pesticide formulations as per BIS specifications.

2. Analysis of simple organophosphates & organothiophosphate.

Teaching-learning Activities

- viva voce interviews
- Assignments
- Laboratory based practical components and experiments.

Books recommended:

1. Cremlyn, R. Pesticides.Preparation and Modes of Action, John Wiley & Sons, New York, 1978.

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B. Sc. Non-Medical III
SEMESTER-VI

BSNM/BSM -602(i): PHYSICAL CHEMISTRY
(Common for B.Sc. Medical and Non-Medical)

Maximum Marks: 100 — L T P 4 0 0
No. of Lectures: 60
(i) External Examination: 75 — Time: 3 hrs.
(ii) Internal Assessment: 25 — Pass Marks: 35%

Course Objectives

- To study the basic postulates of quantum mechanics and application of quantum mechanics of simple system.
- To provide knowledge of chemical bonding by the use of quantum chemistry that how to calculate their bonding and antibonding molecular wave functions.
- To enable students to study the various spectroscopic techniques for determination of bond length and the isotopic effect on vibrational-rotational spectrum.
- To give idea of vibrational frequencies of different functional group.
- To give idea of photochemistry for the determination of quantum yield.

Course Outcomes

On the completion of this course, students will be able to:

CO1: Apply the applications of quantum mechanics in the study of structure of atoms, bonding in molecules and molecular spectroscopy.

CO2: explain the physical states of elementary particles and atoms in different systems based on quantum mechanics.

CO3: explain the basic concepts of photochemistry.

CO4: Characterize the kinetics of deactivation processes and their role in the photochemical reactivity.

INSTRUCTIONS FOR THE PAPER- SETTER

The question paper will consist of 3 units: unit I, unit II and unit III. Unit I and II will have 4 questions from respective unit of the syllabus and will carry 12 marks each. Unit III will consist of 9 questions from the whole syllabus and will carry 3 marks each.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt 2 questions from each Unit I & Unit II. Unit III is compulsory.

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Note: Internal Assessment will be given on the basis of semester test, class performance, attendance, assignment/quiz.

UNIT-I

Quantum Mechanics (15 Lectures)

Introduction, black body radiation, Kirchhoff's law, Plank's radiation law, photoelectric effect, heat capacity of solids , origin of quantum mechanics, relation between quantum and classical mechanics, Bohr model of atom, defects of Bohr model of atom, de Broglie relationship, Heisenberg Uncertainty principle, Compton effect, Schrodinger wave equation, eigen function and eigen value, significance of wave function, normalized and orthogonal wave function, operators, postulates of quantum mechanics, particle in one dimensional box , quantization of energy levels, zero point energy, particle in three dimensional box, separation of variables, concept of degeneracy.

Chemical Bonding (9 Lectures)

Covalent bonding, valence bond theory (VBT) and molecular orbital theory (MOT), LCAO molecular orbital treatment of H_2^+ and H_2 molecules, valence bond treatment of H_2 molecule, comparison of LCAO-MO and VB treatment of H_2, hybridization of atomic orbitals, quantum mechanical principle of hybridization, calculation of wave functions of hybrid orbitals, comparison of VBT and MOT.

Photophysical Chemistry (6 Lectures)

Characteristics of electromagnetic radiation, difference between thermo-chemical and photochemical reactions, Lambert-Beer law and its limitation, laws of photochemistry, quantum yield, determination of quantum yield, examples of low and high quantum yield, luminescence, chemiluminescence, photosensitization, photo inhibitors, Jablonski diagram, Fluorescence and Phosphorescence.

UNIT-II

Introduction to spectroscopy (7 Lectures)

Electromagnetic radiation, interaction of electromagnetic radiation with molecules, Born oppenheimer approximation, absorption and emission spectroscopy, difference between atomic and molecular spectroscopy, types of spectroscopies, selection rules, width and intensities of spectral lines.

Rotational Spectroscopy (7 Lectures)

Diatomic molecules, energy levels of rigid rotator, selection rules, spectral intensity distribution using population distribution, determination of bond length, qualitative description of non-rigid rotator, isotopic effect.

Vibrational Spectroscopy (11 Lectures)

Infrared spectrum, energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond

energies, vibrational energy levels of anharmonic oscillator, vibrational-rotational spectra and isotopic effect on vibrational-rotational spectrum, idea of vibrational frequencies of different functional groups.

Electronic Spectroscopy **(5 Lectures)**

Introduction to electronic spectra, Franck Condon Principle, electronic transitions, singlet and triplet states, selection rules for electronic transitions in molecules.

Teaching-learning Activities:

- Assignments
- Seminar presentation
- Group tutorial work
- Use of e-learning resources and self-study materials.

Books Recommended:

1. IRAN. Levine, Quantum Chemistry, 6th Ed.
2. R.K. Prasad Quantum Chemistry 4th Ed.
3. Dr.Mahendra , R .Awode , Quantum Chemistry revised edition.
4. A.K. Chandra, Introductory Quantum Chemistry, 4th Ed.
5. Fundamentals of Molecular & Spectroscopy, Tata McGraw-Hill Education, 1994.
6. A. Singh and R. Singh, Photochemistry, Campus Book International, 2009.
7. B.R Puri, L.R Sharma, K. C Pathania ,Principles of Physical Chemistry.
8. K.K. Rohtagi, Fundamentals of Photochemistry, Revised 2nd Ed.
9. R.S. Drago, Physical Methods for Chemists, Saunders College Pub., 1992.

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B.Sc. Non-Medical III
SEMESTER-VI

BSNM/BSM-602(i)(P): PHYSICAL CHEMISTRY PRACTICAL
(Common for B.Sc. Medical and Non-Medical)

Maximum Marks: 50 No. of Lectures: 60
Time allowed: 4 hrs.

Course Objectives

- To make students learn about handling of instruments like colorimeter, refractometer and conductometer.
- The students will learn to do acid-base titration to find out end points.
- To make them find out distribution in coefficient and strength of $CuSO_4$ and $KMnO_4$.
- To enable them to find the CST, CSC for phenol-water system eutectic point for two component system.

Course Outcomes

On the completion of this course, students will be able to:

CO1: Determine the cell constant with the help of a conductometer.

CO2: Measure the strength and equivalence point of different types of the electrolytes by the use of a Conductometer.

CO3: measure the specific and molar rotation by using Abbe refractometer.

CO4: Apply the concepts of Beer-Lambert's law to different samples.

CO5: construct the phase diagram for two component system.

Instructions: Practical examination will be conducted in one single day and marks distribution will be as follows:

Notebook: 5 marks

Viva: 10 marks

Write-up and Performance: 35 marks

1. Determination of refractive index of a liquid by Abbe refractometer; Determination of specific and molar refraction.

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2. To test the validity of Beer Lambert law using a calorimeter and determine unknown conc. of a solution
3. Phase Equillibria:
4. To determine distribution coefficients of iodine between CCl_4 and H_2O.
5. Conductometric Titrations:
6. Determination of end point of titration of mixture of strong acid and weak acid using strong base.
7. 5. To determine the strength of $CuSO_4.5H_2O$ solution colorimetrically.
8. To determine the strength of $K_2Cr_2O_7$ solution colorimetrically.
9. To determine the CST and CSC for phenol/water system.
10. 8. To find the eutectic point for two component systems i.e. naphthalene\benzoic acid system.

Teaching-learning Activities:

- Viva-Voce
- Laboratory-based practical component and experiments
- Workshops

Books Recommended:

1. Khosla, B. D.; Garg, V. C. &Gulati, A., Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).
2. Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. Experiments in Physical Chemistry 8th Ed.; McGraw-Hill: New York (2003).
3. Halpern, A. M. & Mc Bane, G. C. Experimental Physical Chemistry 3rd Ed.; W.H. Freeman & Co.: New York (2003).
4. Jagdamba Singh, R.K.P. Singh, Jaya Singh, L.D.S Yadav, I.R Siddiqui, Jaya Srivastava Advanced Practical Chemistry.
5. V K Ahluwalia, Sunita Dhingra, Adarsh Gulati, Practical Chemistry.

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B.Sc. Non-Medical III/ Medical
SEMESTER-VI

BSNM/BSM (DSE)-602(ii): INORGANIC CHEMISTRY-II
(Common for B.Sc. Medical and Non-Medical)

Maximum Marks: 100 **No. of Lectures: 60**
(i) External Examination: 75 **Time: 3 Hrs.**
(ii) Internal Assessment: 25 **Pass Marks: 35%**

Course Objectives

- To give the students a thorough knowledge of different theories of bonding
- To make them understand different types of electronic transitions involved in metal transition complexes and their electronic spectra
- To familiarize them about the magnetic behaviour of transition metal complexes
- To find out symmetry elements in simple molecules
- To make them understand the reactions taking place in non-aqueous solvents

Course Outcomes

On the completion of this course, the students will be able to:

CO1: list the symmetry elements, symmetry operations present in simple inorganic molecules

CO2: Understand electronic spectra of transition metal complexes and predict electronic transitions in various complexes

CO3: Determine splitting of d orbitals due to ligand field in different geometries

CO4: Find out term symbols arising out of various configurations and determine splitting of these term symbols under ligand field.

CO5: Construct Orgel diagrams for d^1, d^2, d^3, d^4, d^6, d^7, d^8, and d^9 octahedral and tetrahedral configurations.

CO6: Compare approach of crystal field theory and molecular orbital theory towards bonding in complexes.

CO7: Understand reactions taking place in non-aqueous solvents.

CO8: Predict magnetic behaviour and find out magnetic moments of transition metal complexes.

INSTRUCTION FOR THE PAPER- SETTER

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The question paper will consist of 3 units: unit I, unit II and unit III. Unit I and II will have 4 questions from respective units of the syllabus and will carry 12 marks each. Unit III will consist of 9 questions from the whole syllabus and will carry 3 marks each.

INSTRUCTION FOR THE CANDIDATES

Candidates are required to attempt 2 questions from each Unit I & Unit II. Unit III is compulsory.

Note: Internal Assessment will be given on the basis of semester test, class performance, attendance and assignment/quiz/seminars.

UNIT-I

Introduction to symmetry (8 Lectures)

Basics of symmetry, symmetry elements and symmetry operations, Point groups for simple molecules like H_2O, NH_3, $PtCl_4^{2-}$, BF_3, C_6H_6

Crystal Field Theory (12 Lectures)

Crystal field effect, octahedral symmetry, Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields, Tetrahedral symmetry, Factors affecting the magnitude of Dq, spectrochemical series, comparison of CFSE for Oh and Td complexes, Tetragonal distortion of octahedral geometry, Jahn-Teller distortion, Square planar coordination, Crystal Field effects on ionic radii, lattice energies and heats of Ligation, Introduction to Charge Transfer Spectra

Molecular Orbital Theory (10 Lectures)

Modern Crystal Field theory, Evidences of covalent bonding, Molecular orbital theory, Sigma bonding in octahedral complexes, Pi bonding in octahedral complexes.

UNIT-II

Electronic Spectra of Transition Metal Complexes (13 Lectures)

Types of electronic transitions, selection rules for d-d transitions, relaxation to selection rules, spectroscopic ground states, spectrochemical series, Orgel energy level diagrams for d^1, d^2, d^3, d^7, d^8, d^9 states, discussion of electronic spectra of $[Cr(H_2O)_6]^{3+}$ $[Ti(H_2O)_6]^{3+}$ and $[Ni(H_2O)_6]^{2+}$, $[V(H_2O)_6]^{3+}$ complex ion, Tetrahedral complexes like $[Co(Cl)_4]^{2-}$ and Jahn Teller effect.

Magnetic Properties of Transition Metal Complexes (12 Lectures)

Types of magnetic behaviour, methods of determining magnetic susceptibility, Curie law, Neel's point, spin-only formula, L-S coupling, correlation of μ_s and μ_{eff} values, orbital contribution to magnetic moment, temperature independent paramagnetism, magnetic behaviour of first row transition metal compounds

Non-aqueous solvents (5 Lectures)

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Physical properties of solvents, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid ammonia and liquid sulphur dioxide**.**

Books Recommended

1. J.E. Huheey, Inorganic Chemistry, Prentice Hall, 3rd Ed.
2. F.A. Cotton and Wilkinson; Inorganic Chemistry.
3. B.R. Puri, L.R. Sharma and K. C. Kalia, Principle of Inorganic chemistry, Milestone Publishers, Delhi.
4. J. D. Lee, Concise Inorganic chemistry, ELBS.
5. Greenwood, N.N. & Earnshaw, Chemistry of the Elements, Butterworth-Heinemann, 1997.
6. Atkin, P. Shriver & Atkins Inorganic Chemistry 5th Ed. Oxford University Press (2010).

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B.Sc. Non-Medical/Medical III
SEMESTER-VI
BSNM/BSM (DSE)-602(ii)(P): INORGANIC CHEMISTRY PRACTICAL-II
(Common for B.Sc. Medical and Non-Medical)

Maximum Marks: 50 No. of Lectures: 60
Time allowed: 4 hrs.

Course Objectives

- The course aims to develop skills of performing gravimetric and volumetric analysis for estimation of metal ions.
- To learn the metal-ligand concept using UV-Visible spectrophotometer.
- To impart knowledge of preparing nano particles and coordination compounds.
- To impart the knowledge of use of instruments such as pH-meter, UV-Vis Spectrophotometer and Fluorescence spectrometer.

Course Outcomes

On the completion of the course, the students will be able to:

CO1: Operate various analytical instruments such as UV-visible spectrophotometer and Fluorimeter.

CO2: Perform gravimetric/volumetric determination of various metal ions

CO3: Carry out synthesis of simple coordination compounds

CO4: Characterise metal complexes by recording their UV-Vis spectra.

CO5: Perform pH-metric titrations

CO6: Determine metal ions spectrophotometrically by complexation with suitable ligands

CO7: Recording the fluorescence spectra of organic dyes and explain fluorescence quenching phenomenon

Instructions: Practical examination will be conducted in one single day and marks distribution will be as follows:

Notebook: 5 marks

Viva: 10 marks

Write-up and Performance: 35 marks

1. **Gravimetric Analysis**

a) Estimation of Copper as Cupric oxide in a solution of Copper Sulphate.

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b) Estimation of Barium as Barium Sulphate in barium chloride solution.

2. **Volumetric Analysis**

a) Determination of Ca^{2+} in milk by complexometric titrations

b) To determine the strength in gm/litre of a given copper sulphate solution being provided with an approx. N/30 sodium thiosulphate solution

3. **pH-metric titrations**

a) Acid-base titrations.

b) Mixture of acid with a base.

4. Synthesis of Nanoparticles of ZnO/ZnS/Ag.

5. Spectrophotometric determination of iron (II) as 1,10-phenanthroline complex

6. Determination of Ni (II) with dimethylglyoxime spectrophotometrically

7. Record the absorption spectra of first transition series metal ion aquo complexes by spectrophotometric method.

8. Preparation of acetylacetonate complexes of Cu^{2+}/Fe^{3+}. Find the λ_{max} of the complex.

9. To study the quenching phenomenon of organic dye using fluorescence spectroscopy.

Books Recommended:

1. Practical Inorganic Chemistry, G. Marr, B. W. Rockett, (1972).

2. Inorganic Chemistry, I. Grenthe, E. Nordin, 18 (1979) 1869–74.

3. Inorg. Synth., J.C. Bailar, M. Eldon, 1 (1939) 35–38

4. Vogel's *Qualitative Inorganic Analysis,* Revised by G. Svehla. Pearson Education, 2002.

5. Instrumental Methods of Analysis, Willard, Hobert H. et al: 7th Ed. Wardswor Publishing Company, Belmont, California, USA, 1988.

Teaching-learning activities

- Viva voce interviews
- Hands on Training
- Workshops and Visits

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B.Sc. Non-Medical/Medical III
SEMESTER-VI

BSNM/BSM (DSE) 602(iii): ANALYTICAL METHODS IN CHEMISTRY
(Common for B.Sc. Medical and Non-Medical)

Maximum Marks: 100 L T P 4 0 0
No. of Lectures: 60
(i) External Examination: 75 Time: 3 hrs.
(ii) Internal Assessment: 25 Pass Marks: 35%

Course Objectives

- To develop understanding among students regarding various analytical techniques.
- To make them familiar with various instrumentation techniques.
- To make them well versed in interpretation of analytical data**.**

Course Outcome

On the completion of this course, students will be able to:

CO1: analyse different errors using statistical methods in Chemical analysis.

CO2: evaluate errors in chemical analysis through statistical treatment of data through F-test, T-test and Q-test.

CO3: develop an insight of the practical methods for performing thermogravimetric analysis, potentiometric and conductometric titrations and their graph analysis

CO4: learn the concept of solvent extraction and apply it in metallic and organic compound extractions

CO5: adopt different chromatographic techniques for isolation of important organic compounds as they gain basic knowledge of various chromatographic techniques and corresponding stationary phases & mobile phases.

CO6: explain the basic principle and instrumentation of various spectroscopic techniques.

CO7: develop skills in problems solving, critical thinking and analytical reasoning.

INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three units: unit I, unit II and unit III. Unit I and II will have 4 questions from respective unit of the syllabus and will carry 12 marks each. Unit III will consist of 9 questions from the whole syllabus and will carry 3 marks each.

INSTRUCTIONS FOR THE CANDIDATES

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Prof. (Dr.) Sonal Singhal
Mr. Ravinderjeet Singh
Ms. Rachna Bhardwaj
Dr. Ajay Sharma
Mr. Puneet Bhardwaj
Mrs. Priya Sharma

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Candidates are required to attempt 2 questions from each Unit I & Unit II. Unit III is compulsory.

Note: Internal Assessment will be given on the basis of semester tests, class performance, attendance and assignment/quiz.

Unit-I

Qualitative and quantitative aspects of analysis (5 Lectures)

Sampling, evaluation of analytical data, errors, accuracy and precision, methods of their expression, normal law of distribution if indeterminate errors, statistical test of data; F, Q and t test, rejection of data, and confidence intervals.

Optical methods of analysis (8 Lectures)

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; Basic principles of quantitative analysis: estimation of metal ions from aqueous solution, geometrical isomers, keto-enoltautomers. Determination of composition of metal complexes using Job's method of continuous variation and mole ratio method.

Infrared Spectrometry (8 Lectures)

Basic principles of instrumentation (choice of source, monochromator& detector) for single and double beam instrument; sampling techniques.Structural illustration through interpretation of data, Effect and importance of isotope substitution.

Other spectroscopies (9 Lectures)

Flame Atomic Absorption and Emission Spectrometry: Basic principles of instrumentation (choice of source, monochromator, detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace level of metal ions from water samples.

Unit-II

Thermal methods of analysis (5 Lectures)

Theory of thermogravimetry (TG), basic principle of instrumentation.Techniques for quantitative estimation of Ca and Mg from their mixture.

Electroanalytical methods (10 Lectures)

Classification of electroanalytical 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.

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Separation techniques **(7 Lectures)**

Solvent extraction: Classification, principle and efficiency of the technique. Mechanism of extraction: extraction by solvation and chelation. Technique of extraction: batch, continuous and counter current extractions. Qualitative and quantitative aspects of solvent extraction: extraction of metal ions from aqueous solution, extraction of organic species from the aqueous and non-aqueous media.

Chromatography **(8 Lectures)**

Classification, principle and efficiency of the technique. Mechanism of separation: adsorption, partition & ion exchange. Development of chromatograms: frontal, elution and displacement methods. Qualitative and quantitative aspects of chromatographic methods of analysis: IC, GLC, GPC, TLC and HPLC. Stereoisomeric separation and analysis: Measurement of optical rotation, calculation of Enantiomeric excess (ee)/ diastereomeric excess (de) ratios and determination of enantiomeric composition using NMR, Chiral solvents and chiral shift reagents. Chiral chromatographic techniques using chiral columns (GC and HPLC).

Teaching Learning activities:

- Student directed learning: Small groups of students are given individual assignments and then they introduce their assignment in the form of Powerpoint presentation.
- Lectures supported by group tutorial work.
- Technology enabled learning.
- Visit to the industries or institutions with analytical instrument facilities.
- Workshops based on Spectroscopic techniques.

Books recommended:

1. 1.G.H. Jeffery, J. Bassett and J. Mendham, R.C. Vogel's Textbook of Quantitative Chemical Analysis, John Wiley & Sons, 1989.
2. H. H. Willard, L. L. Merritt, J. Dean and F. A. Settoe, Instrumental Methods of Analysis, 7th Ed. Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988.
3. G. D. Christian, Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004.
4. D. C. Harris, Exploring Chemical Analysis, Ed. New York, W.H. Freeman, 2001.
5. D. A. Skoog, F. J. Holler and T. A. Nieman, Principles of Instrumental Analysis, Cengage Learning India Ed.

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B.Sc. Non-Medical III
SEMESTER-VI

BSNM/BSM 602(iii)(P): ANALYTICAL METHODS IN CHEMISTRY
(Common for B.Sc. Medical and Non-Medical)

Maximum Marks: 50 No. of Lectures: 60
Time allowed: 4 Hrs.

Course Objectives

- To enable students to study the chromatographic techniques like Paper Chromatography and Thin Layer Chromatography in the separation of various components in a mixture.
- to determine the pH of a given solution.
- It will help them understand solvent extraction techniques and flame photometric methods.

Course Outcomes

On the completion of this course, students will be able to:

CO1: demonstrate various chromatographic techniques (paper chromatography and Thin Layer chromatography) and their applications in separation of various components in a mixture.

CO2: apply the concept of solvent extraction in metallic and organic compound extractions.

Instructions: Practical examination will be conducted in one single day and marks distribution will be as follows:

Notebook: 5 marks

Viva: 10 marks

Write-up and Performance: 35 marks

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.

(c) Chromatographic separation of the active ingredients of plants, flowers and juices by TLC

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2. Solvent Extractions:

(a) 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.

(b) Solvent extraction of zirconium with amberliti LA-1, separation from a mixture of irons and gallium.

3. Determine the pH of the given aerated drinks fruit juices, shampoos and soaps.

4. Determination of Na, Ca, Li in cola drinks and fruit juices using flame photometric techniques.

Teaching-learning Activities:

- Viva-Voce
- Laboratory-based practical component and experiments
- Workshops

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B.Sc. Non-Medical III

SEMESTER-VI

BSEC(C)-604 PHARMACEUTICAL CHEMISTRY

(Common for B.Sc. Medical and Non-Medical)

Time Allowed: 3 Hours Max. Marks: 50

Credits: 2 Minimum pass marks 35%

Course Objectives:

- To provide students with knowledge of the chemistry relevant to the study of pharmaceutical drugs and fermentation process.
- To students will also get hands on preparation of such dosage forms in the the laboratory components.

Course Outcomes

On the completion of this course, the students will be able to:

CO1: Handle various sophisticated instruments like UV-spectrophotometer and FT-IR.

CO2: analyse the data obtained from UV and FT-IR used in structure elucidation of compounds.

CO3: develop the skill in preparation of various pharmaceutical drugs. (Aspirin, Ibuprofen, Pencillin, Sulphacetamide, Streptomycin).

Theory Syllabus:

Drugs & Pharmaceuticals, Drug discovery, design and development; Basic Retrosynthetic approach. Synthesis of the representative drugs of the following classes: analgesics agents, antipyretic agents, anti-inflammatory agents (Aspirin, paracetamol, lbuprofen); antibiotics (Chloramphenicol, Penicillin, Streptomycin); antibacterial and antifungal agents (Sulphonamides; Sulphanethoxazol, Sulphacetamide); antiviral agents (Acyclovir).

Practicals

1. Preparation of any three pharmaceutical drugs. (Aspirin, Ibuprofen, Penicillin, Sulphacetamide, Streptomycin)
2. Preparation of magnesium bisilicate (Antacid).
3. Analysis of prepared compounds by UV-Visible spectrophotometry and column chromatography.
4. UV-Vis spectrophotometric assay of pharmaceutical formulations containing Pharmacopoeial compounds as active ingredients.
5. Study and interpretation of the FT-IR/IR spectra of prepared compounds.

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Teaching-learning Activities:

- Viva-Voce
- Laboratory-based practical component and experiments
- Workshops

Books recommended:

1. G.L. Patrick: Introduction to Medicinal Chemistry, Oxford University Press,
2. UK. Hakishan, V.K. Kapoor: Medicinal and Pharmaceutical Chemistry, Vallabh
3. Prakashan, Pitampura, New Delhi. William O. Foye, Thomas L., Lemke, David A. William: Principles of Medicinal Chemistry, B.I. Waverly Pvt. Ltd. New Delhi.
4. Pharmacopoeia of India.
5. British Pharmaceutical codex.
6. Martindale's Extra pharmacopoeia

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