

Department of Chemistry

Minutes of Departmental Academic Committee (DAC) meeting held on 20-05-2022

Agenda: To finalize the scheme and syllabi for the proposed M.Sc program in Chemistry

Date: 20th May 2022 at 11.00 a.m. onwards

Venue: HOD room of Department of Chemistry

Departmental Academic Committee meeting has been held on 20th May 2022 from 11.00am onwards in the Department of Chemistry, HOD room.

Following officials were present in the meeting

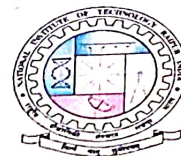
1. Dr. Shyama Prasad Mahapatra, Associate Professor-Chemistry, Head-Chemistry, Chairman, DAC
2. Dr. (Mrs.) Kavita Tapadia, Associate Professor and Convener, DAC
3. Dr. (Mrs.) Fahmida Khan, Professor-Chemistry and Member
4. Dr. (Mrs.) Tungabidya Maharana, Assistant Professor-Chemistry and Member
5. Dr. Santhosh Penta, Assistant Professor-Chemistry and Member
6. Dr. Kafeel Ahmad Siddiqui, Assistant Professor-Chemistry and Member
7. Dr. Neeraj Vishwakarma, Assistant Professor-Applied Geology, External Member
8. Dr. Debasisha Mishra, Assistant Professor-Mathematics, External Member
9. Dr. (Mrs.) Sagarika Bhattacharya, Assistant Professor-Chemistry
10. Dr. S. S. Umare, Prof. (HAG), VNIT Nagpur, Nagpur, External Academic Expert
11. Dr. A.S.P. Mishra, Head, Environment, BALCO-INDIA, Korba, Chhattisgarh, External Industrial Expert

The proposed scheme for M.Sc in Chemistry program was presented in front of Departmental Academic Committee with external experts. The recommendations of the committee are as follows:

1. It is decided that M. Sc. Chemistry program with 80-90 Credits can be proposed for approval. Hence, Department of Chemistry Propose the program M. Sc. in Chemistry with 84 credits.
2. The distribution of scheme is as follows:

M.Sc. Chemistry (NIT Raipur)

[Signatures of officials]



In first semester: 4 theory subjects and 2 laboratory courses.

In second semester: 4 theory subjects and 3 laboratory courses.

In third semester: 4 theory subjects and 3 laboratory courses including project phase-I and summer internship introduced to encourage the students for Industrial exposure.

In fourth semester: Student has to select 2 elective subjects out of 4 and one project phase-II has been recommended.

As per the suggestions and recommendations of DAC members and external experts minor modifications of the earlier proposed scheme has been made. And the total number of credits has been changed from 87 to 84. Department of Chemistry is submitting the proposal for Master Degree in Chemistry.

The proposed scheme and syllabi for M.Sc. in Chemistry is vetted and recommended for approval.

Dr. (Mrs.) Fahmida Khan
Member

Dr. (Mrs.) Tungabidya Maharana
Member

Dr. Santhosh Penta
Member

Dr. Kafeel Ahmad Siddiqui
Member

Dr. Neeraj Vishwakarma
External Member

Dr. Debasisha Mishra
External Member

Dr. (Mrs.) Sagarika Bhattacharya
Assistant Professor, Chemistry

Dr. (Mrs.) Kavita Tapadia
Convener, DAC

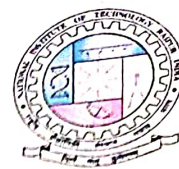
Dr. S. S. Umare
Prof. In Chemistry & VNIT
Nagpur,
DAC External Member

Dr. A.S.P. Mishra
HEAD-Environment
BALCO-India, Korba, CG.
DAC External Member

Dr. S.P. Mahapatra
HOD, Chemistry
Chairman-DAC
Department of Chemistry
NIT Raipur


Dean Academic Affairs,

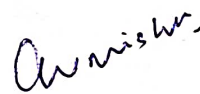
M.Sc. Chemistry (NIT Raipur)

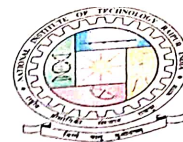


Annexure No-II
Department of Chemistry
M.Sc. Chemistry
Scheme

Course Work	Semester I	Semester II	Semester III	Semester IV
Core Course (Theory)	16	16	16	8
Core Course (Lab)	6	8	3	0
Project/ Dissertation	-	-	5	6
Credit	22	24	24	14
Total Credit(s)	84			


20/05/2022
Dr. S. S. Umare


Dr. A. S. P. Mishra

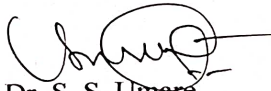


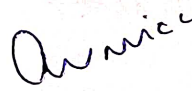
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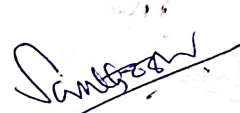

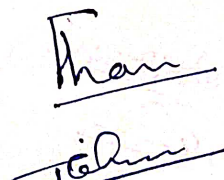
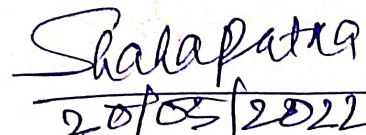
Annexure No- III

M.Sc.-Chemistry I Year: Semester-I						
S. No.	Subject Code	Subjects	L	T	P	Credit
THEORY						
1.	Paper-I	Main group and Transition Metal Chemistry	3	1	-	4
2.	Paper-II	Organic Reactions and Mechanism	4	0	-	4
3.	Paper-III	Thermodynamics and Electrochemistry	3	1	-	4
4.	Paper-IV	Instrumental Methods of Chemical Analysis	4	0	-	4
PRACTICAL/TRAINING/PROJECT						
5.	Lab- I	Inorganic Chemistry Lab	0	0	6	3
6.	Lab-II	Physical Chemistry Lab	0	0	6	3
Total Credits			22			

L = Lecture; T = Tutorial; P = Practical; CT = Class Test;
TA = Teachers Assessment; ESE = End Semester Examination


Dr. S. S. Umare



Dr. A. S. P. Mishra

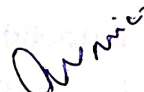





20/05/2022



M.Sc.-Chemistry I Year: Semester- II						
S. No.	Subject Code	Subjects	L	T	P	Credit
THEORY						
1.	Paper-I	Organometallics and Bio-inorganic Chemistry	4	0	-	4
2.	Paper-II	Stereochemistry and Conformational Analysis	4	0	-	4
3.	Paper-III	Quantum Mechanics and Chemical Kinetics	3	1	-	4
4.	Paper-IV	Principles and Applications of Spectroscopy	3	1	-	4
PRACTICAL/TRAINING/PROJECT						
5.	Lab-I	Organic Chemistry Lab	0	0	6	3
6.	Lab-II	Analytical Chemistry Lab	0	0	6	3
7.	Lab-III	Computer Lab	0	0	4	2
Total Credits			24			

L = Lecture; T = Tutorial; P = Practical; CT = Class Test;
TA = Teachers Assessment; ESE = End Semester Examination

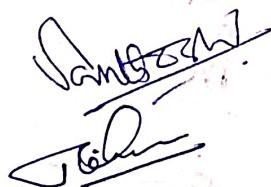

Dr. S. S. Umare


Dr. A. S. P. Mishra

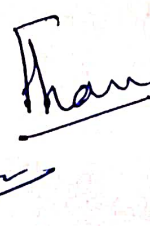


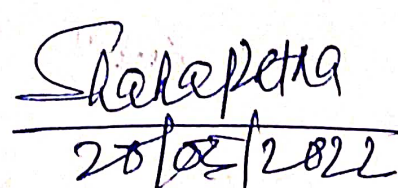


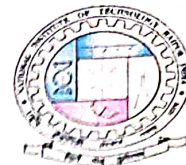










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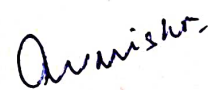




**M.Sc.-Chemistry
II Year: Semester- III**

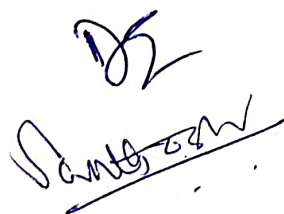
S. No.	Subject Code	Subjects	L	T	P	Credit
THEORY						
1.	Paper-I	Science of Materials	4	0	-	4
2.	Paper-II	Synthetic Organic and Green Chemistry	4	0	-	4
3.	Paper-III	Photochemistry and Pericyclic Reactions	4	0	-	4
4.	Paper-IV	Environmental Chemistry	4	0	-	4
PRACTICAL/TRAINING/PROJECT						
5.	Lab - I	Environmental Chemistry Lab	0	0	6	3
6.	Lab - II	Project Phase-I	0	0	6	3
7.	Lab-III	Summer Internship & Report	0	0	4	2
Total Credits			24			

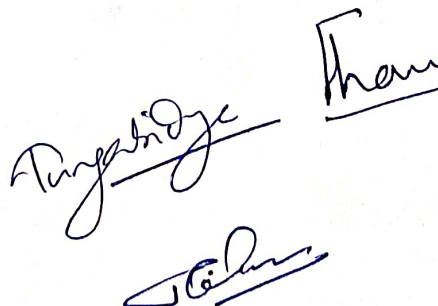
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20/05/2022
Dr. S. S. Umare


Dr. A. S. P. Mishra






20/08/2022



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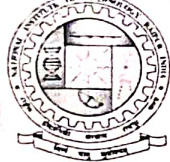
M.Sc.-Chemistry II Year: Semester- IV							
S. No.	Subject Code	Subjects		L	T	P	Credit
THEORY							
1.	Paper-I	Elective-I	1. Nanoscience and Nanotechnology Or 2. Industrial Chemistry	4	0	-	4
2.	Paper-II	Elective-II	1. Advanced Heterocyclic Chemistry Or 2. Solid State and Supramolecular Chemistry	4	0	-	4
PRACTICAL / TRAINING / PROJECT							
3.	Lab-I	Major Project, Presentation & Dissertation		0	0	12	6
Total Credits				14			

L = Lecture; T = Tutorial; P = Practical; CT = Class Test;
TA = Teachers Assessment; ESE = End Semester Examination

SUMMARY				
Semester	I	II	III	IV
Credit Per Semester	22	24	24	14
Total Credits	84			

20/05/2022
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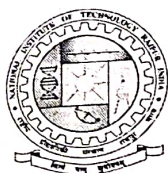


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DEPARTMENT OF CHEMISTRY
TEMPLATE FOR PROPOSING SYLLABUS
M. Sc. (Chemistry) Semester I

1.	Department proposing the course	Chemistry
2.	Course Title	Main group and Transition Metal Chemistry
3.	L-T-P Structure	3-1-0
4.	Credits	4
5.	Course number (Code)	
6.	Status (Core/Elective)	Core
7.	Pre-requisites (course no./title)	NA
8.	Frequency of offering	Paper I, Semester-I
9.	Course Objectives (CO): At the end of this course learner will be able to acquire knowledge on colour, oxidation states and magnetism of the coordination metal complexes. This course will inculcate innovative thinking and research culture.	
10.	Unit I-Transition metal Chemistry (14hrs) Valence bond theory, Crystal field theory, measurement of $10 Dq (\Delta_o)$, CFSE in weak and strong fields, Octahedral vs. tetrahedral coordination, tetragonal distortions from octahedral geometry, square planar geometry. Qualitative aspect of Ligand field and MO Theory. Nephelauxetic series, Orgel diagrams for $3d^1$ - $3d^9$ ions and their spectroscopic ground states; selection rules for electronic spectral transitions; Electronic spectra of metal complexes-Charge transfer spectra. Unit II-Magnetism and Colour (8 hrs) Orbital and spin magnetic moments, spin only moments of d^n ions and their correlation with effective magnetic moments, including orbital contribution; quenching of magnetic moment: super exchange and ferromagnetic/antiferromagnetic interactions; Magnetic Susceptibility and Magnetic Dipole Moments; Curie-Weiss Law. Qualitative Chelate effect, polynuclear complexes, Labile and inert complexes. Stability constant. Unit III-Main group Chemistry (8 hrs) Structure and bonding of boranes and carboranes, styx notation; Wade's rule; electron count in polyhedral boranes; isolobal analogy; boron heterocycles; borazine, boron halides. Isopoly and heteropoly acids, structural features of P-N compounds, structural features and reactivity of S-N heterocycles, halides of nitrogen and sulfur, thionic acid, thio- and per-sulfates, chemistry of halogens, reactivity of polyhalides, pseudo halides. Unit IV-f-Block Elements (10 hrs) Lanthanide and Actinide Elements: Nuclear stability, terrestrial abundance and distribution, relativistic effect, electronic configuration, oxidation states, aqueous-, redox- and complex-chemistry; electronic spectra and magnetic properties. Lanthanide and actinide contractions and their consequences, separation of lanthanides and actinides and their applications (examples) (10 hrs)	
11.	Text and Reference Books:	

Handwritten signatures and names:
K. K. Thakur, D. S. Prasad, S. K. Singh, Anurag, Anurag, Chandra, S. K. Thakur



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1. J. E. Huheey, E. A. Keiter, R. L. Keiter and O. K. Medhi, Inorganic Chemistry Principles of Structure and Reactivity, Pearson.
2. Catherine E. Housecroft and A. G. Sharpe, Inorganic Chemistry, Pearson.
3. N. N. Greenwood and A. Earnshaw, Chemistry of the Elements, Elsevier.
4. W. U. Malik, G. D. Tuli and R. D. Madan, Selected Topics in Inorganic Chemistry, S. Chand.
5. F. A. Cotton and G. Wilkinson: Advanced Inorganic Chemistry, Wiley.

Kapoor

Tham

Dr

Dr

Dr

Pingla

Santhosh

Anand

Chand

Shalendra



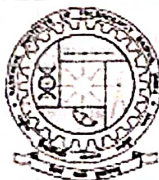
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DEPARTMENT OF CHEMISTRY
TEMPLATE FOR PROPOSING SYLLABUS
M.Sc. I SEMESTER

1.	Department proposing the course	M.Sc.-Chemistry
2.	Course Title	Organic Reaction Mechanism
3.	L-T-P Structure	4-0-0
4.	Credits	4
5.	Course number (Code)	
6.	Status (Core/Elective)	Core
7.	Pre-requisites (course no./title)	NA
8.	Frequency of offering	Paper-II, Semester-I
9.	Course Objectives (CO): At the end of this course learner will be able to <ol style="list-style-type: none">1. The basics of reaction mechanism and the mechanistic concepts2. The concept of aromaticity and reactions of aromatic compounds3. The fundamentals of reactive intermediates4. The mechanism and different types of substitution and elimination reactions5. The addition reactions of C=C and C=O bonds	
10.	Course Syllabus: UNIT – 1: CONCEPTS IN ORGANIC CHEMISTRY AND AROMATICITY (10hrs) Nature of bonding in organic molecules: Localized and Delocalized chemical bond, conjugation and cross-conjugation, Bonding in Fullerenes, Bonds weaker than covalent, addition compounds. Aromaticity in benzonoid and non-benzenoid compounds, Huckel anti-aromaticity, homo-aromaticity, Aromaticity of Annulenes. UNIT II: GENERATION, STRUCTURE, STABILITY AND REACTIONS INVOLVING THE INTERMEDIATES: (10hrs) <ul style="list-style-type: none">➤ Carbocation- Pinacole-Pinacolone Rearrangements, Favorski Rearrangements, and Fries Rearrangements➤ Carbanion- Claisen Condensation, Perkin Reaction➤ Free Radicals- Acyloin condensation, Hunsdiecker reaction➤ Carbenes- Wolf-Rearrangement, Reimer-Tiemann reaction.➤ Nitrenes- Hofmann Rearrangement, Beckmann Rearrangement➤ Benzyne- Formation and Reactions	

Handwritten signatures:
K. K. Singh, Manoj, P. K. Singh, Santosh, J. K. Singh, Anurag, Shalafeta



UNIT III: SUBSTITUTION AND ELIMINATION REACTIONS: (10hrs)

- The SN-2, SN-1, mechanisms. The neighbouring group mechanism, neighbouring group participation by π and σ bonds, anchimeric assistance. Reactivity effects of substrate structure, attacking nucleophile, leaving group and reaction medium, ambident nucleophile and regioselectivity.
- AROMATIC NUCLEOPHILIC SUBSTITUTION: The SN-1, SN-2 mechanisms. Reactivity effect of substrate structure, leaving group and attacking nucleophile.
- Mechanisms of SE-2, SE-1, electrophilic substitution accompanied by double bond shifts. Effect of substrates, leaving group and the solvent polarity on the reactivity.
- ELIMINATION REACTIONS: The E2, E1 and E1cB mechanisms. Orientation of the double bond. Reactivity, effects of substrate structures, attacking base, the leaving group and the medium.

UNIT IV: ADDITION TO CARBON-CARBON MULTIPLE BONDS: (10hrs)

- Mechanistic and stereochemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals, regio- and chemoselectivity. Addition to cyclopropane ring. Hydrogenation of double and triple bonds, hydrogenation of aromatic rings Hydroboration, Micheal reaction. Shrpless asymmetric epoxidation.

UNIT V: ADDITION TO CARBON-HETERO MULTIPLE BONDS: (10hrs)

- Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds, acids esters and nitriles. Addition of Grignard Reagents, Organo-Zinc and Organo-lithium to carbonyls and unsaturated carbonyl compounds, Wittig reaction. Mechanism of condensation reactions involving enolates - Aldol, and Knoevenagel reactions.

11	Text Books and Reference Books:
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1. Advanced Organic Chemistry, F. A. Carey and R. J. Sundberg, Plenum.
2. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
3. Structures and Mechanism in Organic Chemistry, C. K. Ingold, Cornell University Press.
4. Organic Chemistry, R. T. Morrison and R. N. Boyd, Prentice-Hall.
5. Modern Organic Reactions, H. O. House, Benjamin.
6. Principles of Organic Synthesis, R. O. C. Norman and J. M. Coxon, Blackie Academic and Professional.
7. Pericyclic Reactions, S. M. Mukherji, Macmillan, India.
8. Reaction Mechanism in Organic Chemistry, S. M. Mukherji and S. P. Singh, Macmillan.
9. Stereochemistry of Organic Compounds, D. Nasipuri, New Age International.
10. Some Modern Methods of Organic Synthesis, W. Carruthers, Cambridge Univ. Press.
11. Rodd's Chemistry of Carbon Compounds, Ed. S. Coff
12. Organic Chemistry, Vol 2, I. L. Finar, ELBS.
13. Stereo selective Synthesis: A Practical Approach, M. Nogradi, and VCH.
14. Organic Chemistry, Paula Yurkanis Bruice, Pearson Education.

14. Organic Chemistry, Paula T. Hammond, 1st ed., Pearson Education, Inc., 2007.



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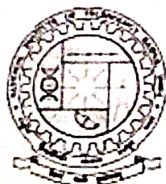
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DEPARTMENT OF CHEMISTRY
TEMPLATE FOR PROPOSING SYLLABUS

M.Sc. (Chemistry) I Semester

1.	Department proposing the course	Chemistry
2.	Course Title	Thermodynamics and Electrochemistry
3.	L-T-P Structure	3-1-0
4.	Credits	4
5.	Course number (Code)	NA
6.	Status (Core/Elective)	Core
7.	Pre-requisites (course no./title)	NA
8.	Frequency of offering	Paper-III, Semester-I
9.	Course Objectives (CO): At the end of this course learner will be able to 1. To learn the thermodynamic principles of system in equilibrium and their associated properties. 2. To understand the phases of coexistence in any reaction or equilibrium. 3. To understand the basic principles of electrochemistry, and their applications.	
10.	Course Syllabus: Thermodynamics and Electrochemistry UNIT I: First Law of Thermodynamics (10 hrs) Basic Terms in Thermodynamics, Thermodynamic Equilibrium, The First law of Thermodynamics, Heat Capacity, Expansion of an ideal gas and changes in Thermodynamics Properties, Joule-Thomson Effect. UNIT II: Thermo chemistry (10 hrs) Change of Internal Energy in a Chemical Reaction, Variation of Enthalpy of Reaction with Temperature: The Kirchoff Equation, Hess's Law of constant Heat Summation, Bond energy and its applications. UNIT III: Second law and Third law of Thermodynamics (10 hrs) Spontaneous process, Cyclic process, Carnot Cycle, Efficiency of Heat engine, Second law of Thermodynamics, Concept of Entropy, Gibbs-Helmholtz Equation, Clapeyron-Clausius Equation, Third Law of Thermodynamics. UNIT IV: Electrolytic conductance (10 hrs) Relation Between Specific Conductance and Equivalent Conductance, Cell Constant, Transport number, Determination of Transport number; Hittorf's Method,	

[Handwritten signatures and names]
Kajand, Manoj, Rakesh, Anish, Sagar, Seelapeta



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Kohlrausch's Law, Calculation of Molar Ionic conductance.

UNIT V: Theories of Electrolytes (10 hrs)

Debye-Huckel Theory of Strong Electrolytes, Debye-Huckel-Onsager Equation, Activity coefficients of Electrolytes, Ionic strength, Debye-Huckel Limiting Law.

11 Text and Reference Books:

1. Physical Chemistry, T. Engel and P. Reid, Pearson, 2006, 1st edition, New Delhi.
2. Thermodynamics, G. N. Lewis and M. Randall, McGraw Hill, 2nd edition, 1961, New York.
3. S. Glasstone, Thermodynamics for chemists, Affiliated East West Press, 1965
4. J. O. M. Bockris and A. K. N. Reddy, Modern Electrochemistry, Plenum Press, 1970.
5. Molecular Thermodynamics, D. A. McQuarrie and Simon. Viva, 2009, 1st edition, New Delhi.
6. J. Rajaram & J. C. Kuriacose, Thermodynamics for Students of Chemistry, Shobanlal Nagin Chand Co, 1986.
7. Atkins, P.W. 'Physical Chemistry', 6th Edn., Oxford University Press, 1998.
8. K. L. Kapoor, A Text Book of Physical Chemistry, Volumes 2 and 5, 3rd Edition, Macmillan India Ltd, 2004.

Kapoor

Tham

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Antony

Aravind

Sharma

Sharma

Shalapatra



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DEPARTMENT OF CHEMISTRY
TEMPLATE FOR PROPOSING SYLLABUS

M.Sc. (Chemistry) I SEMESTER

1.	Department proposing the course	Chemistry
2.	Course Title	Instrumental Methods of Chemical Analysis
3.	L-T-P Structure	4-0-0
4.	Credits	4
5.	Course number (Code)	-----
6.	Status (Core/Elective)	Core
7.	Pre-requisites (course no./title)	NA
8.	Frequency of offering	Paper-IV, Semester-I
9.	Course Objectives (CO): At the end of this course learner will be able to: - <ol style="list-style-type: none"> 1. Explain the theoretical principles underpinning the instrumental methods and their applications in chemical analysis. 2. Assess the appropriateness of the instrumental methods for the chemical analysis. 3. Acquire practical analytical skills and employ a variety of analytical methods. 4. Contribute to team and group work for scientific investigation and reporting. 5. Explore new areas of research in the field of chemical science and allied fields. 	
10.	Course Syllabus: UNIT I: Data Analysis (11hrs) Accuracy, Precision, Errors in chemical analysis: classification of errors, absolute and relative errors, minimization of errors, Statistical data analysis: mean & standard deviation, relative mean deviation, t-test, f-test, relative standard deviation (RSD), Detection limit, Regression analysis, Variation analysis: covariance and correlation coefficient, Confidence analysis, Selectivity and Sensitivity.	

Kaymond Dunlop Des Frank Amis John
DE Shelafeta



राष्ट्रीय प्रौद्योगिकी संस्थान रायपुर
NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
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Website: www.nitrr.ac.in

UNIT I: Atomic Spectroscopy (10hrs)

Atomization techniques: Flame, Electro thermal, Glow-discharge, Hydride and Cold-vapour atomization, Instrumentation: radiation sources, spectrophotometers, Interferences in AAS, Atomic absorption analytical techniques and Applications of ASS, Atomic Fluorescence Spectroscopy, Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)

UNIT III: Electronic Spectroscopy (UV-Vis. Spectroscopy) (10hrs)

Absorption laws, UV-Vis. Spectrum, Formation of absorption band, Chromophore concept, Auxochrome, Absorption and Intensity Shifts, Solvent effects, Fieser-Woodward rules, UV-Vis. Spectrophotometers, Instrumentation & Applications

UNIT IV: Separation and Chromatographic Techniques (12hrs)

Solvent extraction, Chromatography: classifications, elution, chromatograms, migration rates, retention time, Thin-layer chromatography, Ion-exchange chromatography, Gas chromatography, High-performance liquid chromatography (HPLC) & Size-exclusion chromatography.

UNIT V: Electrochemical and Thermal Techniques (12hrs)

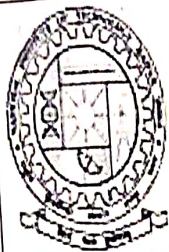
Introduction to Electroanalytical techniques, Potentiometry, Cuolometry, Voltametry, Polarography and Amperometric techniques.

Thermogravimetric analysis (TGA), Differential thermal analysis (DTA), Differential scanning calorimetry (DSC) & Microthermal analysis (MTA)

11 Text Books and Reference Books:

1. Instrumental Method of Chemical Analysis by B. K. Sharma, Krishna Prakashan Media (P) Ltd., Meerut UP.

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Kaplan, Thakur, Singh, Singh, Arunish, Singh, Shahapeta



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2. Instrumental Methods of Chemical Analysis by G.R. Chatwal & S.K. Anand,

Himalaya Publishing House, New Delhi.

3. Fundamental of Molecular Spectroscopy by C.N. Banwell, McGraw Hill Book.

4. Principles of Instrumental Analysis (7th Ed.) by D.A. Skoog, F.J. Holler & S.R.

Crouch, CENAGE Learning, UK.

5. Instrumental Methods of Analysis, Willard, Merrit, Dean, 5th Edition.

Kapand Angabhy

Ans

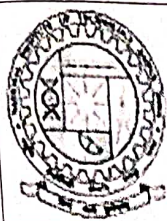
Shankar

Anish

Umesh Tham

DS

Shakappa



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DEPARTMENT OF CHEMISTRY
TEMPLATE FOR PROPOSING SYLLABUS
M. Sc. (Chemistry) Semester-I

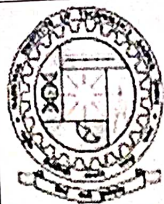
1.	Department proposing the course	Chemistry
2.	Course Title	Inorganic Chemistry Lab
3.	L-T-P Structure	0-0-6
4.	Credits	3
5.	Course number (Code)	
6.	Status (Core/Elective)	Core
7.	Pre-requisites (course no./title)	NA
8.	Frequency of offering	Lab I, Semester-I
9.	Course Objectives (CO): At the end of this course learner will be able to perform hand on experiments using UV-vis spectrophotometer. Student will learn to prepare coordination complexes and study their properties using IR.	
10.	Course Syllabus: List of Experiments: Experiment 1-5 Qualitative analysis of mixture of compounds containing two rare elements and insoluble. Rare elements: Ti, V, Mo, W, Zr, Ce, U. Insoluble Samples: PbSO ₄ , BaSO ₄ , SrSO ₄ , CaF ₂ , Cr ₂ O ₃ , Al ₂ O ₃ , SiO ₂ , SnO ₂ , TiO ₂ , ZrO ₂ , CeO ₂ . Experiment 6 Colorimetric determination of Fe ²⁺ as phenanthroline complex. Experiment 7 Colorimetric determination of Manganese as MnO ₄ ⁻ . Experiment 8 Spectrophotometric experiment - determination of composition of a complex (Job's method). Experiment 9 Syntheses and characterization of coordination compounds of [Co(NH ₃) ₆]Cl ₃ . Experiment 10 Syntheses and characterization of coordination compounds of [Co(NH ₃) ₅ Cl]Cl ₂ . Experiment 11 Syntheses and characterization of coordination compounds of [Co(NH ₃) ₅ N ₃]Cl ₂ .	

Kapoor
Raghuveer

Das
Santosh

Aravind
Dr

Umesh Kumar
Sharma



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	<p>Experiment 12</p> <p>Syntheses and characterization of coordination compounds of $[\text{Co}(\text{acac})_3]/[\text{Fe}(\text{acac})_3]$.</p> <p>Experiment 13</p> <p>Syntheses and characterization of coordination compounds of $[\text{FeCp}_2]$.</p>
11	<p>Reference Books:</p> <ol style="list-style-type: none">1. A. I. Vogel, Revised by G. H. Jeffery, J. Bassett, J. Mendham & R. C. Denney. Vogel's Textbook of Quantitative Chemical Analysis (Latest ed.).2. V. V. Ramanujam, Inorganic Semi-micro Qualitative Analysis, 3rd Edition, National Publishing Company.3. G. Brauer (Ed.), Handbook of Preparative Inorganic Chemistry (Vol. I and II), Academic Press.

Kapoor Singh
D

Sharma

Anand

Chandra Shekhar

Shalendra



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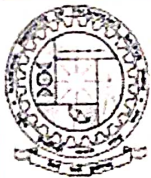
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DEPARTMENT OF CHEMISTRY
TEMPLATE FOR PROPOSING SYLLABUS

M.Sc. (Chemistry) I Semester

1.	Department proposing the course	Chemistry
2.	Course Title	Physical Chemistry Laboratory
3.	L-T-P Structure	0-0-6
4.	Credits	3
5.	Course number (Code)	NA
6.	Status (Core/Elective)	Core
7.	Pre-requisites (course no./title)	NA
8.	Frequency of offering	Lab-II, Semester I
9.	Course Objectives (CO): At the end of this course learner will be able to 1 To teach the students about good laboratory practices, safety of oneself and others in the laboratory. 2. To acquire the different practical skills, hand on training on basic equipment, for research. 3. To train the students in accepting the challenges in Chemistry.	
10.	Course Syllabus: List of Experiments: Experiment 1 Determination of Viscosity of the given liquid by Viscometer. Experiment 2 Determination of surface tension of the given liquid by Stalagmometer. Experiment 3 To determine distribution coefficient I_2 between CCl_4 and water by verifying Nernst distribution law. Experiment 4 To Study the Acid catalyzed hydrolysis of an ester (Methyl Acetate) under Pseudo conditions (first order reaction) and determine the rate constant (k) Experiment 5 Determine the concentration of the given strong acid (HCl) solution by titrating it with standard strong base (NaOH) conductometrically. Experiment 6 Determine the concentration of the given weak acid (CH_3COOH) solution by titrating it with standard strong base (NaOH) conductometrically. Experiment 7 To determine the cell constant for a given cell at room temperature.	

Handwritten signatures and names:
Kannan, Manoj, Prakash, Santosh, Anurag, Virendra, Skelapala



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Experiment 8

To determine the dissociation constants of acetic acid and to verify the Ostwald's dilution law

Experiment 9

To determine distribution coefficient of acetic acid between n-Butanol and water.

Experiment 10

Determination of solubility and solubility product of sparingly soluble salt by conductometrically.

Experiment 11

To study acid catalysed inversion of sucrose at different concentrations of acid and determination of rate constants at different concentrations of the acid.

Experiment 12

Determination of dissociation constant of weak acid by Potentiometric titration.

11

Text Books:

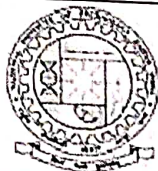
1. Practical Physical Chemistry, A. M. James and F.E. Prichard, Longman.
2. Findley's Practical Physical Chemistry, B. P. Levitt, Longman.
3. Vogel's Text book of Quantitative Analysis, revised, J.Bassett, R.C.Denney, G.H. Jeffery and J.Mendham, ELBS.

12

Reference Books:

1. Experimental Physical Chemistry, R. C. Das and B. Behera, Tata McGraw Hill, 1983, New Delhi.
2. Fundamentals of Analytical Chemistry, D.A.Skoog, D.M.West and F.J.Hollar. 7th Edition, Harcourt College Publishers, 1996.

Handwritten signatures and notes:
Kafle, R. Singh, D. S. Thakur, Armita, V. K. Singh, V. K. Singh, S. K. Singh, S. K. Singh






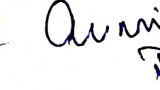
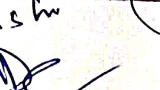

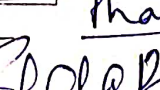


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DEPARTMENT OF CHEMISTRY
TEMPLATE FOR PROPOSING SYLLABUS
M.Sc. (Chemistry) Semester-II

1.	Department proposing the course	Chemistry
2.	Course Title	Organometallics and Bio-inorganic Chemistry
3.	L-T-P Structure	4-0-0
4.	Credits	4
5.	Course number (Code)	
6.	Status (Core/Elective)	Core
7.	Pre-requisites (course no./title)	NA
8.	Frequency of offering	Paper-I, Semester-II
9.	Course Objectives (CO): At the end of this course learner will be able to 1. Know detailed bonding concepts in organometallic chemistry. 2. Understand Industrially important homogenous catalysis cycles. 3. Know Mechanistic aspects of several well-known industrial catalytic techniques. 4. Understand bio-inorganic chemistry of elements.	
10.	Course Syllabus: UNIT I: Structure and bonding in organometallics: (10hrs) 18/16-electron rule, types of metal-carbon bonds, metal carbonyls, bonding, nitrosyls, dinitrogen complexes, phosphines, metal alkyls, aryls, hydrides, π -bonding ligands and dihydrogen complexes, Metal – Metal Bonds, metallocenes, electronic structure and bonding in ferrocene, fluxional molecules, Isolobal Analogy, Organometallic Clusters. Unit II: Reaction mechanism: (10hrs) Ligand substitution, oxidative addition and reductive elimination, C-H and C-C activation, 1,1; Insertion and disinsertion reactions, 1,2-insertion, addition and elimination reactions, alkene isomerization, hydrocyanation, Asymmetric Hydrogenation, hydrogenation of olefins, hydroformylation of olefins, Unit III: Catalysis: (10hrs) Homogeneous and heterogeneous catalysis, Grubbs catalyst, Wilkinson's catalyst, Wacker-Process, Monsanto acetic acid process, Fischer-Tropsch process, Hydrosilylation, Water gas Shift reaction, Ziegler-Natta polymerization, Heck reaction-Suzuki coupling Unit IV: Bio-inorganic Chemistry I: (10hrs) Inorganic Elements in Organisms, Vitamin and Coenzyme B12, Photosynthesis, The Dioxygen Uptake, Transport and Storage, Hemoglobin and Myoglobin, Hemerythrin and Hemocyanin, cytochromes, Iron-Sulfur and Other Non-heme Iron Proteins, ferredoxins, Rubredoxins, Siderophores, Ferritin, Nickel-containing Enzymes, Copper-containing Proteins, Unit V: Bio-inorganic Chemistry II: (10hrs) Function and Transport of Alkali and Alkaline Earth Metal Cations; Catalysis and Regulation of Bioenergetic Processes by the Alkaline Earth Metal Ions Mg^{2+} and Ca^{2+} ; Biomineralization; Biological Functions of the Nonmetallic Inorganic Elements, Biological nitrogen fixation / Nitrogen cycle, Biochemical Behaviour of Radionuclides and Medical Imaging – Chemotherapy.	



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11 Text and Reference Books:

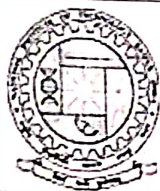
1. J. E. Huheey, E. A. Keiter and R. L. Keiter, Inorganic Chemistry, Principles of Structure and Reactivity, 4th Edition, Harper Collin College Publishers, 1993.
2. F. A. Cotton, Wilkinson, G. and P. L. Gaus, *Basic Inorganic Chemistry*, 3rd Edn., John Wiley & Sons, New York, 1995.
3. G.O. Spessard and G. L. Miessler, Organometallic Chemistry, 2nd Edn, Oxford University Press.
4. R.H. Crabtree, The Organometallic Chemistry of Transition Metals, 4thEdn Wiley-VCH.
5. W. Kaim & B. Schwederski, Bioinorganic Chemistry: Inorganic Elements in the Chemistry of Life, John Wiley (1994).
6. S. J. Lippard & J. M. Berg, Principles of Bioinorganic Chemistry, Panima Publ. Corpn. (2005).
7. C. Elschenbroich, Organometallics, 3rdEdn, Wiley VCH.

Kaplan Dinghoo Dad

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Anamika
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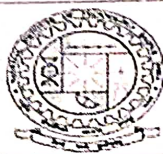
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DEPARTMENT OF CHEMISTRY
TEMPLATE FOR PROPOSING SYLLABUS
M.Sc. (Chemistry) II Semester

1.	Department proposing the course	Chemistry
2.	Course Title	Stereochemistry and Conformational Analysis
3.	L-T-P Structure	4-0-0
4.	Credits	4
5.	Course number (Code)	
6.	Status (Core/Elective)	Core
7.	Pre-requisites (course no./title)	NA
8.	Frequency of offering	Paper II, Semester II
9.	Course Objectives (CO): At the end of this course learner will be able to 1. Development of the concept of about the orientation and arrangement of molecules/atoms in 3D space. 2. Utilize the idea about the application of stereochemistry and conformational analysis for the elucidation and stereo-specific approach for the synthesis novel molecules. 3. Utilize to understand the optical properties of the molecules.	
10.	Course Syllabus: UNIT I: Introduction (12 hrs) Elements of symmetry, chirality, molecules with more than one chiral center, point group. Stereo-chemical Principles-Enantiomeric Relationship diastereomeric relationship, R and S, E and Z cis-trans, syn-anti, nomenclature, asymmetric synthesis, stereo-specific and stereo selective reactions, threo and erythro isomers. Axial and planar chirality and helicity (P & M). UNIT II: Topocity of Ligands (10 hrs) Topocity of ligands and faces and their nomenclature; Stereogenicity, chirogenicity, and pseudoasymmetry, stereogenic and prochiral centers, prochiral relationship. Simple chemical correlation of configurations with examples, quasiracemates. UNIT III: Stereochemistry and Configuration of Acyclic and Biphenyl Systems (12 hrs) Stereochemistry and configuration of allenes, spiranes, alkylidene cycloalkanes, adamantanes, catenanes, biphenyls (atropisomerism), bridged biphenyls and cyclophanes. Stereochemistry of compounds containing N, P and S atoms. Cram's Prelog's and Horeau's rules; Dynamic stereochemistry (acyclic and cyclic).	

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Signature: Anurag
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	<p>UNIT IV: Confirmation of Cyclic System (Monocyclic, Fused Ring and Bridged Ring Molecules) (11 hrs)</p> <p>Confirmations and stability of cyclohexanes (mono-, di- and trisubstituted), cyclohexanones, halo-cyclohexanones, decalins, dealols and decalones; Conformational Analysis of Decalin, Octalins, Hydrindane, Bicyclo[1.1.1] pentane and Bicyclo [2.1.1] hexane, Bicyclo [2.2.1]heptane and Bicyclo[2.2.2]octane; Fused Polycyclic Systems; Perhydrophenanthracenes and Perhydroanthracenes.</p> <p>Unit V: Molecular Dissymmetry and Chiroptical Properties (11hrs)</p> <p>Quantative correlations between Confirmation and reactivity, Curun-Hammett Principle. Linear and polarized light, circular birefringence and circular dichrosim, ORD and CD curves, Cotton effect. The axial haloketone rule, octane diagrams, helicity and Lowe's Rule. Application of ORD and CD to structural and stereochemical problems.</p>
11	<p>Text Books:</p> <ol style="list-style-type: none">1. D. Nashipuri, Stereochemistry of Organic Compounds, 2nd Edition, New Age International (P) Ltd. 2005.2. J. March, Advanced Organic Chemisty, 4th Edition, John Wiley, 20053. Paula Y Bruice "Organic Chemistry" 2nd Edition, Prentice-Hall International, Inc, New Jersey, International Edition (1988).4. P. S. Kalsi, Stereochemistry Conformation and Mechanism 10th Edition, New Age International (P) Ltd. 2019.
12	<p>Reference Books:</p> <ol style="list-style-type: none">1. E. L. Eliel, Stereochemistry of Carbon Compounds, Tata McGraw-Hill Education, 2001.2. J. March, Advanced Organic Chemisty, 4th Edition, John Wiley, 2005.

Keyaand
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Anmisan
Shalapati



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DEPARTMENT OF CHEMISTRY
TEMPLATE FOR PROPOSING SYLLABUS
M.Sc. (Chemistry) II Semester

1.	Department proposing the course	Chemistry
2.	Course Title	Quantum Mechanics and Chemical Kinetics
3.	L-T-P Structure	3-1-0
4.	Credits	4
5.	Course number (Code)	NA
6.	Status (Core/Elective)	Core
7.	Pre-requisites (course no./title)	NA
8.	Frequency of offering	Paper-III, Semester-II
9.	Course Objectives (CO): At the end of this course learner will be able to 1. The topics covered under the course are inherently very fundamental and intended to provide the basic understanding at atomic and subatomic level. 2. Understanding the underlying concepts and realization of quantum mechanics will be useful in solving problems at realistic atomic and molecular level. 3. Students will be able to apply the knowledge gained in this course to explain atomic , molecular spectra and Chemical Kinetics.	
10.	Course Syllabus: Quantum Mechanics and Chemical Kinetics UNIT I: Wave Mechanical Treatment of Simple Systems (10 hrs) Introduction to quantum mechanics (Black body radiation, Planck's quantum theory), Photoelectric effect, Compton effect, Bohr theory of atom, Angular momentum, wave -particle duality, de Broglie equation, Heisenberg uncertainty principle. UNIT II: Simple Quantum Mechanics (10 hrs) Postulates of quantum mechanics, Operators and commutation relations, Hermitian nature of operator, Application of quantum postulates to simple model systems particle in One-dimensional box, particle in Three-dimensional box. UNIT III: Advance Quantum Mechanics (10 hrs) Complete Wave functions and Shape of orbitals, Wave functions of the hydrogenic atom, Radial Probability density, Angular momentum in Quantum Mechanics, Important Theorems of Quantum Mechanics: Viral Theorem, Koopmans' Theorem, Variation Theorem, Hellmann-Feynman Theorem, Kramers Theorem.	

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UNIT IV: Fundamentals of Chemical Kinetics (6 hrs)

Rate laws and Rate constant, Methods for determining the order of a reaction, Mechanisms of complex Reactions, The Equilibrium Approximation, The Steady State Approximation, Franck-Rabinovich effect.

UNIT V: Effect of temperature and Reaction theories (14 hrs)

Effect of Temperature on Reaction Rates, Integrated Arrhenius Equation, Theories of Unimolecular Gaseous Reactions: Lindemann Theory, Rice-Ramsperger-Kassel Theory, Collision Theory of Bimolecular Gaseous Reactions, Activated Complex, Kinetics of reversible reactions, consecutive reactions and chain reactions.

11 Text and Reference Books:

1. Physical Chemistry, P.W. Atkins and J. D. Paulo, Oxford, 2013, 10th edition New Delhi.
2. Introduction to Quantum Chemistry, A.K. Chandra, Tata McGraw Hill, 1997, 4th edition, New Delhi.
3. Quantum Chemistry, Ira N. Levine, Pearson, 2007, 5th edition, New Delhi.
4. Quantum Chemistry, D. A. McQuarrie and Simon, Viva, 2007, 1st edition, New Delhi.
5. Laidler, K. J.; "Chemical Kinetics", 3rd Edition 1997, Benjamin-Cummings. Indian reprint - Pearson 2009.
6. Molecular Quantum Mechanics, Atkins and Friedman, Oxford Univ. Press, 1997, 3rd edition, New York.
7. Quantum Chemistry, J. P. Lowe, Academic Press, 2nd edition, New York.
8. Quantum Chemistry- R.K. Prasad, New Age International (P) Ltd
9. Quantum Chemistry through problems and solution- R. K. Prasad New Age International
10. Chemical Kinetics and Dynamics; Jeffrey I Steinfeld, Joseph S. Francisco and William L. Hase. Prentice Hall, 2nd edition, 1998.

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DEPARTMENT OF CHEMISTRY
TEMPLATE FOR PROPOSING SYLLABUS
M.Sc. (Chemistry) II SEMESTER

1.	Department proposing the course	Chemistry
2.	Course Title	Principles and Applications of Spectroscopy
3.	L-T-P Structure	3-1-0
4.	Credits	4
5.	Course number (Code)	-----
6.	Status (Core/Elective)	Core
7.	Pre-requisites (course no./title)	NA
8.	Frequency of offering	Paper-IV, Semester-II
9.	Course Objectives (CO): At the end of this course learner will be able to: - 1. Understand the principles and applications of spectroscopy. 2. Assess the appropriateness of the spectroscopic techniques for the analysis. 3. Acquire practical analytical and problem solving skills. 4. Contribute to team and group work for scientific investigation and reporting. 5. Explore new areas of research in the field of chemical science and allied fields.	
10.	Course Syllabus: UNIT-I: Molecular Spectroscopy (11hrs) Electromagnetic radiations, Photoelectric effect, Absorption & Emission spectroscopy, Fluorescence Spectroscopy, Atomic & molecular term symbols, Basic elements of practical spectroscopy, Signal-to-Noise: Resolving power, Width and Intensity of spectral transitions, Fourier Transform spectroscopy, Stimulated Emission: Lasers, Enhancement of Spectra: Computer averaging.	

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UNIT II: IR and Raman Spectroscopy (11hrs)

Principles of Infrared Spectrophotometry (IR), Vibrational spectra of Diatomic and Polyatomic molecules, FT-IR, Vibrational frequencies of different functional groups, selection rules, Scattering of Light & Raman Spectroscopy, Classical and Quantum theory of Raman Scattering, FT-Raman Spectrometers, Applications of IR and Raman spectroscopy in qualitative/quantitative analysis

UNIT III: Nuclear Magnetic Resonance Spectroscopy (NMR) (11hrs)

Theory of NMR relaxation process, Precessional & Gyroscopic motion, chemical shifts, Shielding & Deshielding effects, Factors influencing chemical shift, Solvent effect, Proton exchange reactions, The coupling constant, Nuclear spin interaction, Double Resonance (Spin Decoupling), Nuclear Overhauser Effect (N.O.E.), Deuterium Exchange Reaction.

UNIT IV: Electron Spin Resonance (ESR) Spectroscopy and Mossbauer Spectroscopy (11hrs)

Principle of ESR, Magnetic moment of electron and splitting factor, Hyper-fine splitting and double resonance in ESR.

Mossbauer spectroscopy and its principle, Origin of line width, Isomer shift, Quadrupole effects

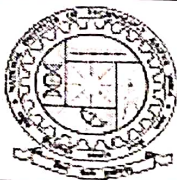
UNIT V: Mass Spectroscopy (2hrs)

Mass spectrometry: Principles, Fragmentation pattern and Fingerprint applications in the interpretation of Mass spectra, effect of isotopes on the appearance of mass spectrum, recognition of the molecular ion peak; Ionization techniques (ESI, TOF and FAB), Instrumentation and Applications

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Text Books and Reference Books:

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1. Elementary Organic Spectroscopy by Y.R. Sharma, S. Chand Publishing.
2. Spectroscopy of organic Compounds by P. S.Kalsi, New Age International.
3. Fundamental of Molecular Spectroscopy by C.N. Banwell, McGraw Hill Book.
- 4.. Principles of Instrumental Analysis (7th Ed.) by D.A. Skoog, F.J. Holler & S.R. Crouch, CENAGE Learning, UK.

Kayal
DZ

Das
Man

Pingaboye
Santosh

Anish
Tabu

Umesh
Shalendra



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DEPARTMENT OF CHEMISTRY
TEMPLATE FOR PROPOSING
SYLLABUS M.Sc. II SEMESTER

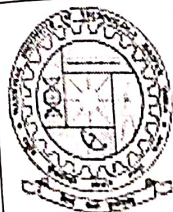
1.	Department proposing the course	M.Sc-Chemistry
2.	Course Title	Organic Chemistry Lab
3.	L-T-P Structure	0-0-6
4.	Credits	3
5.	Course number (Code)	
6.	Status (Core/Elective)	Core Lab
7.	Pre-requisites (course no./title)	NA
8.	Frequency of offering	Lab-1, Semester-II
9.	Course Objectives (CO): At the end of this course learner will be able to <ol style="list-style-type: none">1. Separate and purify the organic compounds2. Perform the basic distillation techniques3. Separate and identification of organic binary mixtures4. Perform single step synthesis of organic compounds	
10.	Course Syllabus: <ol style="list-style-type: none">1. General methods of purification and separation techniques (Demonstrations) Purification of solvents and reagents using techniques like crystallization, sublimation, fractional distillation, vacuum distillation, drying, storage of solvents, solvent extraction and Fractional Crystallization2. Distillation Techniques Simple distillation, Steam distillation, Fractional distillation and Distillation under reduced pressure.3. Organic binary mixtures Separation and Identification of organic binary mixtures containing at least one component with two substituent's. (A student is expected to analyse at least 5 different binary mixtures.)4. Preparation of organic compounds: Single stage preparations<ol style="list-style-type: none">a. Acetylation: Synthesis of β-Naphthyl acetate from β-Naphtholb. Aldol condensation: Dibenzal acetone from benzaldehydec. Bromination: Synthesis of p-Bromoacetanilide from acetanilide / Synthesis of 2,4,6-tri bromo anilined. Friedel Crafts Reaction: o-Benzoyl Benzoic acid from phthalic anhydridee. Oxidation: Adipic acid by chromic acid oxidation of cyclohexanolf. Sandmeyer Reaction: p-Chlorotoluene from p-toluidine	

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K. A. ...
Thar ...
Raj ...
Santosh ...
Anurag ...
Shakpotia



	<p>g. Schotten Baumann Reaction: β-Naphthyl benzoate from: β-Naphthol</p> <p>h. Synthesis of 7-Hydroxy 3-methyl Flavone by Baker Venkatraman method</p> <p>5. Determination of purity of Organic compounds by Melting Point methods.</p> <p>6. Multi Step Synthesis of Organic Compounds:</p> <p>(i) Grignard Reaction: Synthesis of Triphenyl Methanol</p> <p>(ii) Diazotization Reaction: Synthesis of Methyl Orange Dye</p> <p>7. Synthesis of Acridone from Anthranilic acid</p> <p>8. Synthesis of p-bromo benzanilide from benzophenone</p> <p>9. Synthesis of paracetamol from benzene.</p> <p>10. Preparation of 9,10-dihydroanthracene-9,10-endo-α,β-succinic anhydride from anthracene via Diels-Alder reaction</p> <p>11. Estimation of the percentage or number of Amines in an organic compound using Bromate-Bromide Solution</p> <p>12. Estimation of the percentage or number of Phenols in an organic compound using Bromate-Bromide Solution Method.</p> <p>13. Determination of the percentage or number of hydroxyl groups in an organic compound by Acetylation Method</p> <p>14. Isolation of Eugenol from Cloves</p> <p>15. Isolation of Piperene from Black pepper</p> <p>16. Isolation of Caffeine from Tea Leaves</p>
11	<p>Text Books and Reference Books:</p> <ol style="list-style-type: none">1. Practical Organic chemistry by A. I. Vogel.2. Practical Organic chemistry by Mann and Saunders.3. Practical Organic chemistry by Garg and Salija.4. The Systematic Identification of Organic compounds, R. L. Shriner and D. Y. Curtin.5. Semimicro Qualitative Organic Analysis, N.D. Cheronis, J. B. Entrikin and E. M. Hodnett.6. Practical Physical chemistry by Alexander Findlay.7. Experimental Physical chemistry, D. P. Shoemaker, G. W. Garland and J. W. Niber, Mc Graw Hill Interscience.8. Findlay's Practical Physical chemistry, revised B

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K. A. And, Turgabige, [Signature], [Signature], [Signature], [Signature], [Signature], [Signature], [Signature]



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DEPARTMENT OF CHEMISTRY

TEMPLATE FOR PROPOSING SYLLABUS

M.Sc. (Chemistry) II SEMESTER

1.	Department proposing the course	Chemistry
2.	Course Title	Analytical Chemistry Lab
3.	L-T-P Structure	0-0-6
4.	Credits	3
5.	Course number (Code)	-----
6.	Status (Core/Elective)	Core
7.	Pre-requisites (course no./title)	NA
8.	Frequency of offering	Lab-II, Semester-II
9.	Course Objectives (CO): At the end of this course learner will be able to: - This course is designed to give the student an understanding in the operation and care of instruments used in the chemistry /chemical laboratories. 1. To introduce the student to principles and theory of instrument analysis. 2. To teach the student the correct operation of instruments and techniques of troubleshooting instruments in the laboratory. 3. The students will be able to use the instruments for qualitative and quantitative analysis of samples. 4. They will develop and apply the appropriate lab skills and instrumentation to solve chemical problems.	
10.	Course Syllabus: 1. Determination of absorption maximum (λ_{max}). 2. Determination of TDS and Electrical Conductivity. 3. Determination of sodium and potassium ion in environmental sample by Flame Photometer.	

Dr. Anand
Dingra

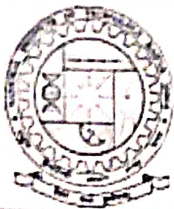
Dr. Anand

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Dr. Anand



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4. Determination of sulphate in environmental sample using turbidometer.
5. Determination of heavy metal ions in various samples using Atomic Absorption Spectroscopy.
6. Preparation of buffer and its pH determination using a pH Meter.
7. Quantification of phosphate in various samples by spectrophotometry.
8. To verify Lambert – beer's law for KMnO_4 spectrophotometrically.
9. Optical Absorption Study of the Surface Plasmon Resonance in nanoparticles.
10. Separation and purification of samples (environmental/biological/chemical) using chromatographic techniques.

11 Text Books and Reference Books:

1. Analytical Chemistry, G. D. Christian, 7th ed, 2013, Wiley Publication.
2. Vogel's Textbook of Quantitative Chemical Analysis, 5th Ed.) G.H. Jeffery, John Wiley & Sons Inc., New York.
3. Standard Methods for the examination of water and waste water, 17th Ed. 1989, APHA-AWWA-WPCS.

Ka/A-c

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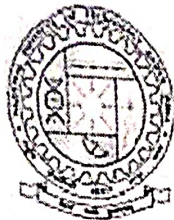
Santosh

Anish

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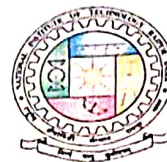
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DEPARTMENT OF CHEMISTRY
TEMPLATE FOR PROPOSING SYLLABUS
M.Sc. (Chemistry) Semester- II

1.	Department proposing the course	Chemistry
2.	Course Title	Computer Lab
3.	L-T-P Structure	0-0-4
4.	Credits	2
5.	Course number (Code)	
6.	Status (Core/Elective)	Core
7.	Pre-requisites (course no./title)	NA
8.	Frequency of offering	Lab-III, Semester-II
9.	Course Objectives (CO): At the end of this course learner will be able to 1. Know the fundamentals of various specialized softwares related to Chemistry 2. Learn Office Components like Word, powerpoint and excel 3. Learn Mastering various advanced components of Origin software 4. Learn Chemistry related softwares like Chemdraw, ACD labs, Mercury, MestRe Nova	
10.	Course Details: 1. Introduction to Computer and its Applications. 2. Learn Typing, drawing etc. using Microsoft word, Excel, and Powerpoint. 3. Learn basic applications of Origin Software like making and analysing graphs 4. Learn basic applications of Chemdraw Software like drawing and analysing structure of molecules 5. Analysis of crystal packing, type and magnitude of hydrogen bonding and other non-covalent interactions by Mercury software. 6. Determination of Area under the peak by using Origin Softwares, 7. Use of Origin software for XRD data analysis 8. Use of Origin software for UV Spectra 9. Use of Origin software for FTIR Spectra 10. Use of Chemdraw for predicting NMR spectra of compounds. 11. Use of Mestre Nova software for analysing NMR spectra	
11	Reference Softwares and Materials: https://www.microsoft.com/en-in https://www.originlab.com/ http://www.cambridgesoft.com/ https://www.ccdc.cam.ac.uk/community/csd-community/freemercurey/ https://mestrelab.com/download/mnova/	

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Department of Chemistry

Minutes of Departmental Academic Committee (DAC) meeting (Hybrid)

held on 03-02-2023

Agenda: To review and finalize the syllabi of Second-Year (III & IV Semester) M.Sc program in Chemistry.

Date: 3rd February 2023 at 03.00 pm onwards

Venue: HOD room of Department of Chemistry

Departmental Academic Committee meeting has been held in hybrid mode on 3rd February 2023 from 03.00pm onwards in the Department of Chemistry.

Following officials were present in the meeting

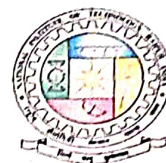
1. Dr. Shyama Prasad Mahapatra, Associate Professor & Head, Department of Chemistry, Chairman, DAC.
2. Dr. (Mrs.) Kavita Tapadia, Associate Professor-Chemistry and Convener, DAC
3. Dr. F. A. Khan, Professor (HAG), IIT Hyderabad, External Academic Expert
4. Dr. S. S. Umare, Professor (HAG), VNIT Nagpur, External Academic Expert
5. Dr. A.S.P. Mishra, Head, Environment, BALCO-INDIA, Korba, Chhattisgarh, External Industrial Expert
6. Dr. (Mrs.) Fahmida Khan, Professor-Chemistry and Member
7. Dr. Kafeel Ahmad Siddiqui, Associate Professor-Chemistry and Member
8. Dr. Neeraj Vishwakarma, Associate Professor & Head, Applied Geology, External Member
9. Dr. (Mrs.) Sagarika Bhattacharya, Assistant Professor-Chemistry

The proposed scheme and syllabi of Second-Year (III & IV Semester) M.Sc in Chemistry program was presented in front of Departmental Academic Committee with external experts. The recommendations of the committee are as follows:

1. It is decided that the proposed scheme with total 84 credits in M. Sc. Chemistry program is recommended. Out of which 22 credits in I Semester, 24 credits in II Semester, 24 credits in III Semester and 14 credits in IV Semester are allotted.
2. The distribution of scheme is as follows:
In I Semester: 4 theory subjects and 2 laboratory courses.

M.Sc. Chemistry (NIT Raipur)

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In II Semester: 4 theory subjects and 3 laboratory courses.

In III Semester: 4 theory subjects and 3 laboratory courses including project phase-I (minor project) and summer internship introduced to encourage the students for Industrial exposure.

In IV Semester: 2 program elective subjects out of 4 and one project phase-II (major project) have been recommended.

3. DAC members including external experts reviewed second-year syllabi, added few recent topics and finally found that the latest theory and laboratory subjects have been included. DAC also recommends for program elective in IV semester and not for open elective at present.

As per the suggestions and recommendations of DAC members and external experts', minor modifications of the earlier proposed syllabi have been made. Department of Chemistry is submitting the revised second-year syllabi for Master Degree in Chemistry. The proposed second-year syllabi for M.Sc. in Chemistry is vetted and recommended for approval.

Dr. F. A. Khan

Dr. S. S. Umare

Dr. A. S. P. Mishra

Dr. N. Vishwakarma

Dr. (Mrs.) Fahmida Khan

Dr. K. A. Siddiqui

Dr. S. Bhattacharya

Dr. (Mrs.) K. Tapadia

Dr. S. P. Mahapatra

Dean Academic Affairs,



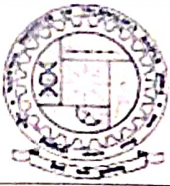
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DEPARTMENT OF CHEMISTRY
TEMPLATE FOR PROPOSING SYLLABUS
M.Sc. (Chemistry) Semester-III

1.	Department proposing the course	Chemistry
2.	Course Title	Chemistry of Materials
3.	L-T-P Structure	4-0-0
4.	Credits	4
5.	Course number (Code)	
6.	Status (Core/Elective)	Core
7.	Pre-requisites (Course no./title)	NA
8.	Frequency of offering	Paper-I, Semester-III
9.	Course Objectives (CO): At the end of this course learner will be able to Learn the basic knowledge on materials and their applications which includes preparation properties and uses of metals and alloys, construction and industrial materials, polymers, elastomers and composites and other engineering materials.	
10.	Course Syllabus: Unit-1: Introduction to Materials Introduction, Classification of Materials: Metals & Alloys, Ceramics, Organic, Engineering, Construction & Industrial, Biomaterials and Nanomaterials. Properties of Materials: Physical, Chemical, Mechanical, Electrical and Magnetic. Selection of Materials. Unit-II: Metals and Alloys Introduction, Ferrous Metals & Alloys: Pig iron, Cast iron, Wrought iron, Effect of impurities on properties of steel, Fe-Carbon system. Non Ferrous Metals and Alloys: Copper, Aluminium, Magnesium, Brass and Nickel (Fe-Ni) alloys. Gibb's phase rule, Eutectic system, Corrosion and Its Control: Introduction, Types: Chemical or dry, Electro-chemical or wet, Others, Mechanisms, Corrosion Control. Unit-III: Construction and Industrial Materials Refractories: Introduction and Properties. Cement: Introduction, Chemical constituents, Manufacture of Portland cement, setting and hardening. Glasses and Ceramics: Manufacture of Glass, Types of Glass. Lubricants: Types, Mechanism of Lubrication and Properties. Materials for protective coatings: Paints and Varnishes. Unit-IV: Polymers, Elastomers and Composites Introduction of polymers, Classification of Polymers, Mechanism of Polymerization, Preparation, properties and uses of Thermoplastic & Thermosetting, Elastomers &	

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H. K. ...
Anish ...
Thar ...
K. ...
S. ...
R. ...
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Vulcanization, Composite Materials, Nanocomposites. Physico-mechanical, visco-elastic and rheological properties of polymers.

Unit-V: Engineering Materials and Applications

Electrical Materials: Characteristics of Conductor, Semiconductors, Insulators, Dielectric, Ferroelectric, Piezoelectric and Thermoelectric Materials and their applications.

Magnetic Materials: Introduction and Classification, Properties: Ferromagnetism, Paramagnetism, Diamagnetism.

Biomaterials: Biofertilizers, Biosurfactants, Biosensors, Biochip and its applications.

11 Text and Reference Books:

1. R. K. Rajput, Material Science and Engineering, Delhi, 2003.
2. Wiley, Engineering Chemistry, Second Edition, 2018.
3. V. Rajendran and A. Marikani, Materials Science, New Delhi, 2004.

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Anmishra
KyAand
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Shalapatna



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DEPARTMENT OF CHEMISTRY
TEMPLATE FOR PROPOSING SYLLABUS
M.Sc. Chemistry - SEMESTER- III

1.	Department proposing the course	M.Sc-Chemistry
2.	Course Title	Synthetic Organic and Green Chemistry
3.	L-T-P Structure	4-0-0
4.	Credits	4
5.	Course number (Code)	
6.	Status (Core/Elective)	Core
7.	Pre-requisites (course no./title)	NA
8.	Frequency of offering	Paper-II, Semester - III
9.	Course Objectives (CO): At the end of this course learner will be able to <ol style="list-style-type: none"> 1. The use of important reagents in organic synthesis 2. About selected name reactions in Organic synthesis 3. The concept of retrosynthesis, the terms involved and disconnections 4. Concepts of Green chemistry 5. Greener synthetic pathways to synthesize pharmacological compounds 	
10.	Course Syllabus: UNIT I: Organic Reagents: (10hrs) Use of the following reagents in organic synthesis and functional group transformation, LiAlH_4 , NaBH_4 , Gilman's reagent, CH_3Li , lithium diisopropylamide (LDA), Osmium tetroxide, lead tetraacetate, H_2O_2 , m-CPBA. UNIT II: Name reactions in organic synthesis: (10hrs) Peterson olefination, Shapiro reaction, Wittig and its modifications, Palladium based reactions- Suzuki, Heck, Sonagashira, Hiyama, Stille, Sharpless epoxidation, Michael addition, and Dieckman condensations UNIT III: Design of Organic Synthesis: (10hrs) Retro-synthesis the disconnection approach- Basic principles and terminology of retrosynthesis. One group and two group C-X disconnections, one group C-C and two group C-C disconnections. UNIT IV: Green Chemistry - (10hrs) What is Green Chemistry? Need for Green Chemistry. Goals of Green Chemistry. Limitations/ Obstacles in the pursuit of the goals of Green Chemistry. Twelve principles of Green Chemistry with their explanations. Green starting materials, Green reagents, and Green catalysis. UNIT V: Applications of Green Chemistry - (10hrs) Green methods of synthesis: Microwave assisted reactions, Ultrasound assisted	

Kapilendra Singh

Manoj

Dr. Anurag Mishra

Dr. Lalaputra



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reactions. Green solvents—Water as a solvent for organic reactions, Ionic liquids, PEG, and solvent less processes. Green Synthesis of Ibuprofen, Adipic acid, disodium iminodiacetate (alternative to Strecker synthesis). Common multicomponent reactions with green synthesis including synthesis like Biginelli reaction, Hantzsch synthesis etc.,

11

Text and Reference Books:

1. House, Modern Synthetic Reaction, 1973.
2. S. Warren, Organic Synthesis The Disconnection approach, Wiley and sons, 2002.
3. S. Warren, Organic Synthesis The Synthron approach, 2nd Edn, Wiley and sons, 1991.
4. M. B. Smith, J. March, March's Advanced Organic Chemistry, John Wiley & Sons, 6th Edn, 2007.
5. R. R. Carey and R. J. Sundburg, Advanced Organic Chemistry, Part A and Part B, Springer, 5th Edn, 2007.
6. Peter Sykes, A Guide Book to Mechanism in Organic chemistry, Orient-Longman, 6th Edn, 1996.
7. P. Y. Bruice, Organic Chemistry, Pearson Education, 3rd edition, 2006.
8. P.S. Kalsi, Organic Reaction and Their mechanisms, 2nd Edn, New Age International (P) Ltd. 2000
9. Sheldon, R.A., Arends, I., and Hannefed, U., Green Chemistry and Catalysis, Wiley-VCH Verlag GmbH and Co. (2007).
10. Anastas, P., and Williamson, T. C., Green Chemistry Frontiers in Benign Chemical Synthesis and Processes, Oxford University Press (1999).
11. Ahluwalia, V. K., and Kidwai, M., New Trends in Green Chemistry, Anamaya Publishers (2004).

Stephano

Pingal

Das

Santhosh

Anish

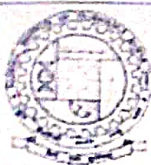
Vinod

Hake

Tham

Uday

Sahapat



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DEPARTMENT OF CHEMISTRY
TEMPLATE FOR PROPOSING SYLLABUS
M.Sc. (Chemistry); III Semester

1.	Department proposing the course	Chemistry
2.	Course Title	Photochemistry and Pericyclic Reactions
3.	L-T-P Structure	4-0-0
4.	Credits	4
5.	Course number (Code)	
6.	Status (Core/Elective)	Core
7.	Pre-requisites (course no./title)	NA
8.	Frequency of offering	Paper III, Semester III
9.	Course Objectives (CO): At the end of this course learner will be able to <ol style="list-style-type: none">1. Enrich their knowledge in Photochemistry and pericyclic reactions of organic molecules.2. Understand the concept for advance synthesis of molecules with diverse applications.	
10.	Unit I: Introduction and Basic Principle of Photochemistry [11 hrs] Photochemical energy, Laws of Photochemistry, Photochemical excitation of organic molecule, Types of electronic excitation and molecular orbital view of excitation, Fate of excited molecule -Jablonski Diagram, photolytic cleavage, Quantum yield or quantum efficiency. Unit II: Photochemistry of Carbonyl Compounds and Alkenes [11hrs] Photochemistry of saturated acyclic, cyclic, α - β -unsaturated, β , γ -unsaturated carbonyl compounds, α -cleavage or Norrish type-I process, β -cleavage or Hydrogen abstraction or Norrish type-II process, Intermolecular cycloaddition reactions: The Paterno-Buchi Reaction and The de Mayo reaction, Photosensitized cis-trans-isomerism, cyclization reaction, Di-pi-methane rearrangements, Rearrangement of 1,5,-Diene Unit III: Photochemistry of Aromatic compounds and Introduction to Pericyclic Reactions [11 hrs] Photorearrangements of aromatic compounds: 6π electrocyclization, Photo-isomerisation, Photo addition to amines, photodimerization, and photo addition to olefins. Pericyclic Reactions and their classifications, Pi-MOs of simple conjugated system. Unit IV: Electrocyclic Reactions [11 hrs] Introduction, Stereochemistry of electrocyclic reactions. Conrotatory and Disrotatory Motion: Application in Ring opening and Ring closing reactions, Open chain conjugated system having $4n\pi$ and $(4n+2)\pi$ conjugated electrons.	

Dr. Anand Prasad
Tham

Dr. Anand Prasad
H. K. S. S.

Dr. Shalokha



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	Unit V: Frontier Molecular Orbital Approach (FMO) of Electrocyclic Reactions: [12 hrs] FMO Method, Cyclization of $4n\pi$ and $(4n+2)\pi$ conjugated electrons: thermal and photoinduced ring opening, Nazarov cyclization, Selection rule and microscopic reversibility, Correlation Diagram, Selection Rules: Woodward and Hoffmann selection rules and Hückel-Mobius (H-M) method or Perturbation molecular orbital (PMO) method. Cycloaddition reactions, 1,3-dipolar addition reactions and Sigmatropic rearrangements.
11	Books Recommended: 1. S. S. Gupta, Basic Stereochemistry of Organic Molecules, 2 nd Edition, Oxford University Press 2018. 2. Jagdamba Singh, Jaya Singh, Photochemistry and Pericyclic Reactions, 4 th Edition, New Age International (P) Limited, 2019 3. K. C. Majumdar, P. Biswas, A Textbook of Pericyclic Reactions, 1 st Edition, MEDTECH Publications, 2015. 4. K. K. Rohtagi-Mukherjee, Fundamental of Photochemistry, 3 rd Edition New Age International (P) Limited, 2014
12	Reference Books: 1. Ian Fleming, Pericyclic Reactions, 2 nd Edition, Oxford University Press, 2015

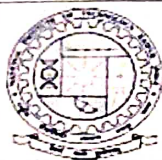
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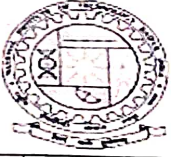
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DEPARTMENT OF CHEMISTRY
TEMPLATE FOR PROPOSING SYLLABUS
M.Sc. (Chemistry) III SEMESTER

1.	Department proposing the course	Chemistry
2.	Course Title	Environmental Chemistry
3.	L-T-P Structure	4-0-0
4.	Credits	4
5.	Course number (Code)	-----
6.	Status (Core/Elective)	Core
7.	Pre-requisites (course no./title)	NA
8.	Frequency of offering	Paper-IV, Semester-III
9.	Course Objectives (CO): At the end of this course learner will be able to: - 1. Students can apply the knowledge to the environmental challenges. 2. To acquire the sense of responsibility to safeguard the environment as a constitutional duty. 3. To develop sustainable strategies to protect the environment and acquire practical analytical and problem solving skills. 4. Contribute to team and group work for scientific investigation and reporting. 5. Explore new areas of research in the field of Environment.	
10.	Course Syllabus: UNIT I: Introduction to Environmental Chemistry (10hrs) Concept and scope of environmental chemistry, environmental segments, energy and mineral resources, structure and function of ecosystems, sustainable development, toxic chemicals and Persistent organic pollutants (POPs) in the environment, carrying capacity of Environment, Environment Impact Assessment(EIA).	

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H. K. ...
V. K. ...
Anish ...
1. ...
Shalapati



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UNIT II: Air Pollution (11hrs)

Atmosphere and its function, Air-quality standards, primary and secondary air pollutants and its adverse effect, climatic issues, global issues, global warming, acid rain, ozone depletion, photochemical smog, carbon emission, carbon capture, carbon pricing etc., prevention and control of air pollution.

UNIT III: Water Pollution (11hrs)

Water-quality parameters and standards (BIS, WHO), water pollution, water analysis, water quality index, water resources, history of major water pollution episodes, waste water treatment methods.

UNIT IV: Soil Pollution (10hrs)

Soil profile, Nature and importance of soil, soil pollution, types, effects and major sources of soil pollutants, types of solid waste, solid waste management.

UNIT V: Environmental Law, Policies and Society (10hrs)

Function and responsibility of Central and State Boards, necessity and scope of the Environmental Protection Act, Air Act, Water Act, Biomagnifications and Biodiversity, Economics, Society and Environmental Ethics.

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Anand ...
Tham ...
S. K. ...
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Text Books and Reference Books:

1. H. Sharma and B. K. Kaur, "Environmental Chemistry," Goel Publishing House, Meerut, 1995.
2. A. K. De "Environmental Chemistry", New Age International (P) Limited, Publishers, 2017 -
3. S.M. Khopkar, "Environmental Pollution Analysis", New Age International (P),Ltd.
- 4 I.W. Moore and E. A. Moore, Environmental Chemistry, McGraw Hill Publication, New York, 1971.
5. S. S. Dara, "A Text Book of Environmental Chemistry and Pollution Control" S.Chand, 1993.
6. Pollution Control Acts, rules and Notifications issued under CPCB, New Delhi.

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TEMPLATE FOR PROPOSING SYLLABUS
M.Sc. (Chemistry) III SEMESTER

1.	Department proposing the course	Chemistry
2.	Course Title	Environmental Chemistry Laboratory
3.	L-T-P Structure	0-0-6
4.	Credits	3
5.	Course number (Code)	NA
6.	Status (Core/Elective)	Core
7.	Pre-requisites (course no./title)	NA
8.	Frequency of offering	Lab-I. Semester III
9.	Course Objectives (CO): At the end of this course learner will be able to 1. Design experiments, and to interpret results for applications in environmental sample. 2. Develop various analytical processes to meet specified objectives. 3. Solve the scientific problems by critical thinking and analytical reasoning. 4. Understand a working knowledge of environmental chemistry toward sustainable development.	
10.	Course Syllabus: List of Experiments: Experiment 1 Determination of Ca^{2+} and Mg^{2+} ions in water sample by complexometric titration. Experiment 2 Determination of dissolved oxygen in water sample by Iodometric titration. Experiment 3 Determination of acidity/alkalinity of water sample by neutralization titration. Experiment 4 Determination of Iron salt from water sample by using redox titration. Experiment 5 Determination of chemical oxygen demand (COD) and biochemical oxygen demand (BOD) of environmental sample. Experiment 6 Physio-chemical analysis of environmental sample. Experiment 7 Determination of Iron from ore sample. Experiment 8 Determination of Mn in environmental sample.	

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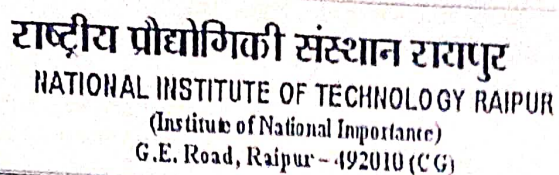
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	<p>Experiment 9 Determination of lead in environmental sample</p> <p>Experiment 10 Analysis of coal.</p> <p>Experiment 11 Determination of Uranium in environmental sample.</p> <p>Experiment 12 Dye degradation study by UV-Vis. Spectrophotometry.</p> <p>Experiment 13 Determination of air quality parameters in environmental sample.</p> <p>Experiment 14 Analysis of adulteration in milk sample.</p>
11	<p>Text Books:</p> <p>1. Experiments in Environmental Chemistry: A Laboratory Manual by D. W Connell and P. D. Vowles.</p>
12	<p>Reference Books:</p> <p>1. Vogel's Textbook of Quantitative Chemical Analysis (Latest ed.). Revised by G. H. Jeffery, J. Bassett, J. Mendham & R. C. Denney.</p>

Kay Angel ^{Pangasinan}
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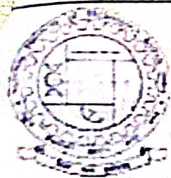
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DEPARTMENT OF CHEMISTRY
TEMPLATE FOR PROPOSING
SYLLABUS M.Sc. IV SEMESTER

1.	Department proposing the course	Chemistry
2.	Course Title	Industrial Chemistry
3.	L-T-P Structure	4-0-0
4.	Credits	4
5.	Course number (Code)	
6.	Status (Core/Elective)	Elective-I
7.	Pre-requisites (course no./title)	NA
8.	Frequency of offering	Paper-I, IV-Semester
9.	Course Objectives (CO): At the end of this course learner will be able to: Learn about industrial materials, fuels, their uses, industrial processes, industrial waste management, and material and energy balance.	
10.	Course Syllabus: UNIT I: Industrial Fuel Classification, Calorific Value, Analysis of Coal, Manufacture of Metallurgical Coke, Petroleum and products, Fractional Distillation, Knocking, Cetane Value, Octane Value, LPG as a Fuel, Natural Gas, Non-conventional energy resources. Unit II: Industrial Processes I:(10hrs) Distillation: Boiling and distillation, vapor-liquid equilibria, Raoult's law & Henry's law, relative volatility, azeotropic mixtures, flash distillation, steam distillation, vacuum distillation, fractional distillation, plate columns (Bubble cap, Sieve plate & Valve plate). Extractions: Liquid equilibria, Extraction with reflux, Extraction with agitation. Unit III: Industrial Processes II :(10hrs) Filtration: Classification of filters, Sand filters, filter press, plates; Flow of Heat, Thermal Conductivity, Thermal Insulation. Evaporation, Types of evaporators, scale and sludge formation, Prevention of scale formation, Boiler corrosion. Gas Absorption, Comparison of absorption and distillation Unit IV: Industrial Waste Management :(10hrs) Definition, Classification, Composition of Solid, Liquid and gaseous wastes, Hazardous and non-hazardous wastes, Solid waste management, Disposal techniques, Minimization of waste, re-use and re-cycling, Industrial waste water, Treatment of waste water: Primary, secondary and tertiary treatments.	

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Unit V: Material and Energy Balance

Material Balance: Process classification, Choice of system, Material Balance Calculations, Recycle and Bypass.

Energy Balance: Forms of energy, Energy Balance, Energy Changes in Physical Processes, Energy Changes in reactions, Energy Balance calculations.

11 Text Books and Reference Books:

1. H. S. Peavy, D.R. Rowe and G. Techbanoglous, Environmental Engineering, McGraw Hill Books Co.
2. Chemical Process Industries. B. Shreeve.
3. Outline of Chemical Industries. Dryden
4. J. F. A. Henglein: Chemical Technology (Pergamon).
5. R.N. Shrove: The Chemical Process Industries (MGH).
6. O.A. Hougen, K.M. Watson and R.A. Ragetz: Chemical Process Principles, Vol. I, II (JW).
7. Industrial Chemistry by B. K. Sharma

Kapoor

Sharma

Das

Halkar

Jain

Sharma

Sharma

Shalapatra



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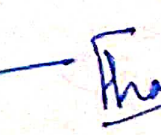
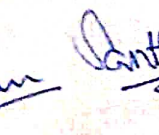
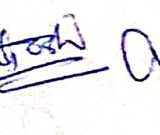
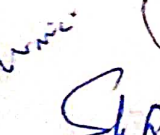

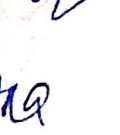
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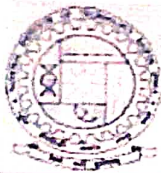
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Website: www.nitr.ac.in

DEPARTMENT OF CHEMISTRY
TEMPLATE FOR PROPOSING SYLLABUS
M.Sc. (Chemistry) Semester-IV

1.	Department proposing the course	Chemistry
2.	Course Title	Nanoscience and Nanotechnology
3.	L-T-P Structure	4-0-0
4.	Credits	4
5.	Course number (Code)	
6.	Status (Core/Elective)	Elective-I
7.	Pre-requisites (Course no./title)	NA
8.	Frequency of offering	Paper-I, Semester - IV
9.	Course Objectives (CO): At the end of this course learner will be able to Learn the basic knowledge on nanoscience and nanotechnology which includes the exotic properties of materials at nanoscale, various techniques available for the processing and characterization of nanostructured materials, applications in selected fields.	
10.	Course Syllabus: Unit-I: Introduction to Nanoscience and Nanotechnology: Principles of Nanotechnology, Properties of materials & nanomaterials, role of size in nanomaterials, Nanostructured Materials, Semiconducting nanoparticles, nanowires, nanoclusters, carbonaceous and metal nanoparticles, importance and social aspects of nanotechnology. Unit-II: Synthesis and Modifications of Nanomaterials: Top down and bottom up approaches, Chemical precipitation and co-precipitation, Sol-gel synthesis, Solvothermal synthesis, Microwave heating synthesis, Electrochemical synthesis, Metal nanocrystals by reduction, organic functionalizations. Unit-III: Basic Tools of Nanotechnology: Basic principles and applications of scanning electron microscopy, energy dispersive spectroscopy, transmission electron microscopy, X-ray diffraction, raman spectroscopy, atomic force microscopy, etc to characterize nanomaterials. Optical microscope, description, operational principle and applications for analysis of nanomaterials, Surface area analysis. Unit-IV: Carbonaceous Nanomaterials: Fullerenes, C ₆₀ , C ₈₀ and C ₂₄₀ nanostructures. Properties & applications (mechanical, optical and electrical), Nano-graphite, Carbon Nanotubes, Nano-fibers. Nanosensors: Temperature sensors, smoke sensors, pressure sensors, sensors for aerospace and defence, integration of sensor	



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with actuators and electronic circuit, biosensors.

Unit-V: Applications of Nanotechnology:

Synthesis of various nanoparticles, Applications in Chemical, Pharmaceutical Environmental, Biotechnology, Electrical, Mechanical, Electronics, Space, Industries, Engineering, and Technology.

11 Text and Reference Books:

1. T. Pradeep, Nano: The Essentials, Tata McGraw-Hill, New Delhi, 2007.
2. G. Cao, Nanostructures and Nanomaterials – Synthesis, Properties and Applications, Imperial College Press, London, 2004.
3. C. N. R. Rao, A. Muller and A. K. Cheetham, The Chemistry of Nanomaterials, Volume 1, Wiley –VCH Verlag GmbH & Co. KgaA, Weinheim, 2004.
4. Ray F. Egerton, Physical Principles of Electron Microscopy: An Introduction to TEM, SEM, and AFM, Springer Publishing, 2005.

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Shyama, Sh, Pham, D, Thiyabage, Santosh, Chhaya, H, Sakapatna



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DEPARTMENT OF CHEMISTRY
TEMPLATE FOR PROPOSING SYLLABUS
M.Sc. (Chemistry) Semester-IV

1.	Department proposing the course	Chemistry
2.	Course Title	Solid State and Supramolecular Chemistry
3.	L-T-P Structure	4-0-0
4.	Credits	4
5.	Course number (Code)	
6.	Status (Core/Elective)	Elective -II
7.	Pre-requisites (Course no./title)	NA
8.	Frequency of offering	Paper II, Semester IV
9.	Course Objectives (CO): At the end of this course learner will be able to <ol style="list-style-type: none"> 1. Understand the concept of crystal lattice and crystal engineering. 2. Understand to apply the concept of crystal engineering in crystal packing in designing of new solids. 3. Understand the concept of supramolecular chemistry to design new material for advance applications. 	
10.	Course Syllabus: Unit I: Introduction Diffraction and Type of Lattices [12 hrs] Crystalline and Amorphous solids, Introduction to X-ray Crystallography: Brief History, The Braggs' Law, Introduction to crystal structure, Body-centered and Primitive structures, Motif, The Lattice and Unit Cells: Lattices, One- and two-dimensional Unit cells, Translational symmetry elements, Three Dimensional Lattices and Their Unit Cells: Triclinic, Monoclinic, Orthorhombic, Tetragonal, Rhombohedral, hexagonal, Cubic, The reciprocal lattice, Miller Indices, Inter-planar Spacing, Bravais Lattices, Quasicrystals, Dimensionality and Molecularity. Unit-II Symmetry operation of Some Space Groups [11 hrs] Axis of Translational Symmetry, Axis of Rotational Symmetry or Screw Axis, Axis of Inversion, Axis of Roto-reflection, Reflection Planes with Translational component (Glide Plane), Point Groups, Space Groups: Detail Study of Some Selected Space Groups (Case study of Triclinic ($P1$ and $P\bar{1}$ space group) and Monoclinic ($P2$, $P2_1$, $P2_1/c$, $P2_1/n$, $C2$, $C2_1$) crystal system) and their role in Crystal Properties of Organic and Metal-organic materials. Unit II: Introduction to Supramolecular Chemistry [08 hrs] Supramolecular Chemistry: Receptors, design and synthesis of co-receptors and Multiple recognition, Hydrogen bonds, strong, weak and very weak H-bonds.	

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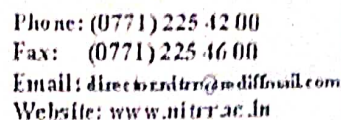
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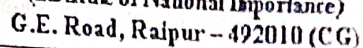
DEPARTMENT OF CHEMISTRY
TEMPLATE FOR PROPOSING SYLLABUS
M.Sc. IV SEMESTER

1.	Department proposing the course	M.Sc-Chemistry
2.	Course Title	Advanced Heterocyclic Chemistry
3.	L-T-P Structure	4-0-0
4.	Credits	4
5.	Course number (Code)	
6.	Status (Core/Elective)	Elective - II
7.	Pre-requisites (course no./title)	NA
8.	Frequency of offering	Paper-II, Semester-IV
9.	Course Objectives (CO): At the end of this course learner will be able to <ol style="list-style-type: none">1. To introduce the students with major classes of heterocyclic compounds and their chemical properties2. To familiarize the students about the reactivities of different classes of heterocycles3. The students will be able to plan synthetic routes to complex organic molecules containing heterocyclic motifs4. The students will be familiar with the major advances and the current state-of-the-art methods in heterocyclic chemistry	
10.	Course Syllabus: Unit 1: Introduction to Heterocycles: (10 hrs) Nomenclature (Hantzsch Widman System), spectral characteristics, reactivity and aromaticity of monocyclic, fused and bridged heterocycles. Unit-2 Aromatic and Non-aromatic Heterocycles: (10 hrs) General chemical behaviour of aromatic heterocycles, classification (structural type), Heteroaromatic reactivity and tautomerism in aromatic heterocycles, Strain -bond angle and torsional strains and their consequences in small ring heterocycles and interactions & conformational aspects on nonaromatic heterocycles.	

Kapil Kumar Singh
DS
Shan

Dr. Anurag
Joshi

Dr. Shalendra



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9. The Essence of Heterocyclic Chemistry, New Age International Publications, 2013.

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