M.Sc. INORGANIC CHEMISTRY SPECIALIZATION

SEMESTER- III

M.Sc. Chemistry (Final) **Semester III**

Paper-I: CH (IC) 301T:Bonding, Group Theory and its Applications

IC-11: Group Theory, Normal mode analysis and Spectral Activity **Dr. B.Sireesha**

Hour-wise Synopsis

S.No.	Topic	Hours
1	Properties of a point group, closure rule-abelion and non-abelion groups, associative rule, inverse rule and identity rule.	1
2	Group multiplication table, the rearrangement theorem, GMT of C_3, C_4, C_{2V}, C_{2h}, C_{3V} and C_5 point groups	2
3	Sub groups-Langrange's theorem, Classes, similarity transformation. Properties of conjugate elements, definition, classes for C_{2V}, C_{3V}	2
4	Matrices and vectors, types of matrices, multiplication and direct product, matrix representation of symmetry elements-E, σ, *i*, Cn and Sn.	2
5	Matrix representation of point groups, product and square rule, Matrices of C_{2h}, C_{2V}, C_{3V} and C_{4V}, block factorization	1
6	Transformation matrices, reducible and irreducible representations, character of a representation, properties of irreducible representation, orthognality principle, construction of character table	2
7	Character tables of C_{2h}, C_{2V}, C_{3V} and C_{4V} groups	1
8	Mulliken symbolism, rules for IRs. Symmetry species for translations and rotations, standard reduction formula	1
9	The direct product, rules of direct products, normal mode analysis, Cartesian coordinate method,C2v, alternate method	1
10	Internal coordinate method C_{2V}- H_2O, IR and Raman activity	1
11	Normal mode/Internal coordinate method for C_{2h} and C_{3V} with examples	1

M.Sc. Chemistry (Final) **Semester III**

Paper-I: CH (IC) 301T:Bonding, Group Theory and its Applications

IC-11: MOT of Metal Complexes **Dr. B.Sireesha**

S.No.	Topic	Hours
1	Limitations of CFT, Adjustments of CFT to allow for covalence	1
2	Experimental evidences for metal-ligand orbital overlap – ESR and NMR studies of few metal complexes	1
3	Adjusted CFT, introduction to MOT	1
4	Symmetry classification of metal and ligand orbitals in non-cubic environment, square pyramidal, trigonal bipyramidal and square planar geometries	2
5	Concept of LGO's, LCAO concepts	1
6	Construction of LGO's for Oh, Td and Sq pl geometries	1
7	Construction of MOED –Oh metal complexes with σ orbitals, σ and π orbitals, σ, π and π* orbitals	2
8	Construction of MOED for Td metal complexes with σ and π orbitals	1
9	Construction of MOED for square planar metal complexes with σ and π orbitals	2
10	MO electronic configuration and calculation of magnetic moment	

Hour-wise Synopsis

M.Sc. Chemistry (Final) **Semester III**

Paper-I: CH (IC) 301T:Bonding, Group Theory and its Applications

IC-11: Electronic Spectroscopy of Metal Complexes **Dr. Ashwini.K**

Hour-wise Synopsis

Topic to be covered	**No. of hours**
Introduction to crystal field diagrams-construction of CFELD of Oh, Td, Square planar geometries, constructionof ligand field diagrams- effect of weak crystal field on S, P, D, f terms	**1**
Construction of Orgel diagrams- d^1,d^6,d^9,d^4; d^2, d^7,d^8,d^3; d^5 configurations, concept of hole formalism, expected electronic transitions	**1**
Construction of correlation diagram for d^2 Oh environments-strong field configurations-calculation of no.of microstates for each strong field configuration by direct product method, and method of descending symmetry. Rule of correspondence and non crossing rule	**2**
Correlation diagram for Td environment and other for orther configurations discussion	**1**
Tanabe-Sugano Diagrams-construction for d^2 and d^8 configuration, comparision of orgel and tanabe-sugano diagrams	**2**
Classification of electronic spectra –ligand field spectra and charge transfer spectra, types of electronic spectral recordings-solid, solution spectra.	**1**
Selection rules for electronic spectra-orbital selection rules-transitions between two non-degenerate states, transitions between states of different degeneracy, two electron transitions	**1**
Spin selection rules, relaxation in rules-departure from cubic symmetry, d-p mixing, vibronic coupling, magnetic dipole transitions	**1**
Nature of spectral bands- band intensities-intensity of d-d band, intensity of C-T band, band widths-variation in 10Dq,lower symmetry components	**1**
Franck condon principle, spin orbit coupling, Jahn-Teller effect,	**1**
Experimental evidence, dynamic JT effect	**1**
Spectrochemical series-factors effecting 10Dq, Nephelauxetic series	**1**
Examples of metal complexes and their detailed electronic spectral charecterisation with values	**1**
Total	**15**

M.Sc. Chemistry (Final) **Semester III**

Paper-I: CH (IC) 301T:Bonding, Group Theory and its Applications

IC-12: IR and Raman Spectroscopy **Dr. Ashwini.K**

Hour wise synopsis

Topic to be covered	**No. of hours**
Introduction to molecular spectra, nature of electro magnetic radiation, mechanism of interaction and ,Hooke's law, force constants, potential energy curve for a vibrating molecule	**1**
Selection rules-conditions for IR activity-HOMO nuclear diatomics and HETERONuclear diatomics, polyatoms	**1**
Anharmonicity of molecular vibrations and potential energy functions,	**1**
Fundamental bands, overtones, and hot bands, fermi resonance	**1**
Partial normal mode analysis-finding out the molecular point group, character table and calculating the no. of reducible representations from standard reduction formula, classifying the RR's into vibrations, rotations and assignment of IRR's for the modes.	**3**
Few more examples for normal mode analysis	**1**
Determination of coordination sites and linkage isomers like NO_2 and SCN, denticity of SO_4^{2-}, CO_3^{2-}	**1**
Distinguishing geometrical isomers- cis & trans , fac and mer isomers	**1**
Effect of coordination on ligand vibrations-mono, bi, polydentate ligands of oxygen, nitrogen, carbon and halogens-NH,H_2O,Glycine, Carbonyl and halides	**1**
Prediction of diagnostic fundamentals of geometrical isomers of metal complexes, distinguishing isomers of metal complexes	**1**
Discovery of Raman effect-Raman experiment, Raman lines-stokes, anti stokes, Rayleigh scaterring, conditions for Raman activity-polarizability	**1**
Raman spectra of CO, HCN, CO_2,NO_2,H_2O, principles of resonance Raman spectra	**1**
Structural elucidation of the active sites of Heme and non meme oxygen carriers.complementary nature of IR and Raman spectra.	**1**
Total	**15**

M.Sc. Chemistry (Final Inorganic**)** **Semester III**

Paper-III:CH(IC) 303T (Elective IIIa): Analytical Techniques - I

Unit: IC-17: Data Handling **K.Sudeepa**

Hour wise synopsis

Topics to be covered	No. of Hours required
Evaluation of Analytical Data: Introduction to Data handling, role in chemical analysis,Error-definition, classification of errors, minimization of errors.	1
Accuracy-Definition, Ways of expressing accuracy, precision-definition, ways of expressing precession	1
Numberical Problems	1
Stastical treatment of finite data- mean,median,average, deviation,standard deviation, variance, coefficient of variance	2
Numberical Problems	1
Significant figures- Definition,mathematicaloperation,addition,subtraction, division, and multiplication,Numberical problems	2
Numberical Problems	1
Students t-test, stastical Q testfor rejection of a result, confidence limit	1
Problems	1
Regression analysis- Method of least squares, problems	1
Correlation coefficient, detection limits, calculations	2
Revision	1
	15hrs

M.Sc. Chemistry (Final Inorganic**)** **Semester III**

Paper-III: CH(IC) 303T: Analytical Techniques-I

Unit: IC-18: AAS, AES, ICP-AES **Dr. P. Muralidhar Reddy**

Hour wise synopsis

Topics to be covered	No. of Hours
Atomic Absorption Spectroscopy (AAS): An Introduction to Optical Atomic Spectroscopy- atomization - Principles of AAS, Instrumentation-Flame Atomization-Electro Thermal Atomization-Graphite Furnace Technique	2
Flame AAS and furnace AAS, resonance line sources, sensitivity and detection limits in AAS.	1
Interferences –chemical and spectral, evaluation methods in AAS and application in qualitative and quantitative analysis.	2
Atomic Emission Spectroscopy (AES): Principles of AES, Instrumentation	2
Evaluation methods, Application of AES in quantitative analysis -RaiesUltima or RU lines-Advantages & disadvantages of AES - Comparison Between Atomic Absorption and Emission Spectroscopy	2
Inductively Coupled Plasma - Atomic Emission Spectroscopy (ICP-AES): Limitations of AES, Principles of plasma spectroscopy, plasma as an excitation source. Inductively coupled plasma source	2
ICP-AES – Instrumentation –sequential spectrometers- Simultaneous spectrometers-Qualitative information- Quantitative information- Application of ICP-AES, Comparison with AAS and AES	2
Flame Photometry: - Basic concept- structure of flame –Interferences - Principle, and Theory	1
Instrumentation and Applications of Flame Photometry	1
	15hrs

M.Sc. Chemistry (Final) **Semester III**

Paper CH(IC) 303T Analytical Techniques – I (Elective IIIa)
Hour-wise Synopsis

IC 19: Diffraction Methods **Dr. A.V.Aparna**

1 **X-Ray Diffraction Methods:** Introduction to diffraction phenomenon; X-rays- introduction to X-rays, their discovery, production – discharge tube, theory of generation of X-rays; instrumentation, Measurement of Intensity- photographic and counter methods.

2 Bragg's equation, Miller indices – calculation of miller indices; Deduction of Structure amplitude from intensity measurement.

3 Methods of Diffraction – powder and single crystal methods.Laue's photographic method – description of the method and detection, Bragg's X-ray spectrometric method – instrumentation and detection of diffracted X-rays.

4 Bragg's method for deduction of crystal structures – fcc, bcc and simple cubic structures. Interpretation of structures of NaCl and KCl.

5 Rotating crystal method – methodology and detection, Powder X-ray diffraction method- instrumentation, diffraction cones/rings, detection on comparison with standard spectra.

6 Indexing reflections, systematic absences, reciprocal lattice concepts; Diffraction studies – contour / electron density maps.

7 Electron density studies of platinum pthalocyanine complex – contour maps and assignment of the atoms on respective positions on contour maps.

8 Electron density studies on silyl acetate and tetra alkyl biphosphate.

9 Advantages of X-ray diffraction studies – determination of bond length, bond anghe, no. of bonds; Limitations of XRD.

10 **Electron diffraction by Gases:** Electron diffraction - introduction, principle and instrumentation.

11 Radial distribution curves; Interpretations of results for $PBrF_2S$, PF_3HS, PF_2HS.

12 Interpretation of results for $HClO_4$, silyl monothioacetate and Germyl monothioacetate; $HgCl_2$ molecule. Advantages and limitations of electron diffraction studies.

13 **Neutron diffraction:** Principle, sources used for neutron diffraction – fast neutrons – their isolation.

14 Applications of neutron diffractionin hydrogen bonding studies, combined use of XRD and Neutron diffraction studies; Advantages and limitations of neutron diffraction studies.

15 Discussion.

M.Sc. Chemistry (Final) **Semester III**

Paper-III: CH(IC) 303T: Analytical Techniques-I

Hour-wise Synopsis

IC-20: Advanced Mass spectrometry **Dr. P. Muralidhar Reddy**

Topics to be covered	No. of Hours
Mass Spectrometry basic introduction- Block diagram of mass spectrometer- Types of ionization methods- Types of ions in mass spectrometer	1
Mass Analyzers: Quadruple, Ion traps, Time of flight (TOF) mass analyzers	2
Mass Spectrometry / Mass Spectrometry: Tandem Mass Spectrometry, Instrumentation, Applications ; LC-MS-MS and GC-MS-MS	2
Hyphenated Techniques: GC-MS Principle, instrumentation, Interfaces- Direct coupling interface and open split interface.	2
Application based on gas chromatography/mass spectrometry-Analysis of metabolite of drug Imipramine.	1
LC-MS- principle, Instrumentation – Interfaces- Moving belt interface, particle beam interface, thermospray interface, Electrospray interface, atmospheric pressure chemical ionization interface.	2
ICP – MS - Principle Instrumentation, and Applications	1
Matrix-assisted laser desorption/ionization-Time of flight Mass spectrometry (MALDI-TOF-MS): Introduction	1
MALDI- TOF-MS - Principle, Matrix, Sample Preparation for MALDI-MS - Dried droplet Crystallization, Thin layer method, Sandwich Crystallization	1
MALDI- TOF-MS -Instrumentation	1
Applications of Matrix-assisted laser desorption/ionization-Time of flight Mass spectrometry in chemistry and biology	1
	15hrs

M.Sc. Chemistry (Final) **Semester III**

Paper CH(IC) 304T: Analytical Techniques - II (Elective IVa)

IC-26 : Thermal methods **Dr.S.Sreekanth**

Hour-wise Synopsis

Topics to be covered	No. of Hours
Thermogravimetric analysis (TGA): Principle, Instrumentation, working function of each component – Block diagram, types of balances, thermistors used	1
Applications of TGA: Study of oxalates (CaC_2O_4, Mg C_2O_4), nitrates ($AgNO_3$ and $Cu(NO_3)_2$)and chromates ($KCrO_4$)by TGA, Determination of carbon black in polythene	2
Differential thermal analysis (DTA): Principle, Instrumentation - block diagram, Methodology – experimental details. Differentiation from TGA	1
Applications of DTA - Differential thermogram of sulphur. Comparison of TG and DTA of manganese phosphine monohydrate	1
Differential scanning calorimetry (DSC): Principle, instrumentation, power compensated DSC instruments and Heat flow DSC instruments – Block diagrams. Working principle.	1
Methodology-DSC experiment calibration and data analysis – Factors affecting DSC curves – instrumental and sample factors – corrections or calibration to be made – standards used in calibration.	1
Applications of DSC: determination Glass transition temperatures and heat capacities. Problems based on Thermal Techniques (TGA, DTA and DSC)	2
Slip test and Revision	-
Thermometric titrations: Principle, apparatus- experimental procedure – enthalpogram, determination of end point.	1
Applications of TT : Acid base (HCl and H_3BO_3 against NaOH – advantage over pH metry), precipitation, complexometric (determination of Calcium and Magnesium ion in a mixture), redox and non-aqueous titrations	2
Combined thermal instruments: Introduction to TGA/MS and TGA/FTIR – block diagram, advantages and application. High resolution TGA, Microthermal analysis	2
Seminar by students	1
	15hrs

M.Sc. Chemistry (Final) **Semester III**

Paper CH(IC) 304T: Analytical Techniques - II (Elective IVa)

Hour-wise Synopsis

IC-26 : Surface Analysis Methods / Microscopic analysis **Dr. A.V.Aparna**

1 Introduction to surface measurements – definition of surface, sampling surfaces, surface contamination, types of surface measurements – Electron Probe, Photon Probe, ion Probe and Scanning Probe microscopy techniques.

2 **Electron Probe Techniques –** classical method – optical microscopy; development of new methods for determination of surface methods, raster scanning pattern, Scanning electron microscopy (SEM) – principle, instrumentation.

3. **SEM –** sources used, sample holders, types of samples, transducers, applications of SEM

4. **Electron Probe Techniques** Transmission Electron Microscopy (TEM) – principle, instrumentation – sources, sample holders, analyzers and transducers.

5 **TEM –** Applications of TEM, comparison of SEM and TEM

6 **Electron Probe Techniques –** Electron Probe X-ray analysis (EPXMA) – principle, instrumentation and applications.

7 **Electron Probe Techniques –** Auger Electron Spectroscopy – principle, Auger electron – emission, Auger transitions, comparison of Auuger spectroscopy with XPS and XFS.

8 **Auger Emission Spectroscopy** - instrumentation and applications of Auger Electron Spectroscopy

9 **Photon Probe Techniques –** X-ray Photoelectron Spectroscopy (XPS) – principle of XPS/ESCA, instrumentation, sources used, sample holders, hemispherical analyzers, Transducers.

10 **ESCA –** Applications of ESCA, Qualitative analysis - determination of kinetic and binding energies, chemical shifts and structures, chemical shifts and oxidation states. Quantitative analysis.

11 **Ion Probe Techniques –** definition of ion probe techniques – types – Rutherford Backscattering Spectrometry (RBS) – principle, elastic collisions, instrumentation, working, helium ion source,

12 RBS – instrumentation – particle and tandem accelerators, detectors, backscattering – measurement of energies of scattered particles, applications of RBS.

13 **Ion Probe Techniques –** Secondary Ion Mass Spectrometry (SIMS) – fundamental aspects of sputtering, principle, instrumentation – ion sources, sample chamber, mass analyzer, detector.

14 **SIMS** - static and dynamic SIMS; ion-microprobe analyzers, applications of SIMS – composition and depth measurements, surface sensitivity.

15 **Atomic Force Microscopy (AFM) –** principle, instrumentation, contact mode scanning, tapping mode operation, Applications of AFM.

15 Discussion.

M.Sc. Chemistry (Final) **Semester III**

Paper CH(IC) 304T **Analytical Techniques - II**
(Elective IVa)

Hour-wise Synopsis

IC-27: Advanced Separation Techniques **K.Sudeepa**

Topics to be covered	No. of Hours required
Introduction to separation techniques:Definition, role of separation in analysis,examples and brief review on basic separation methods	1
Principle, methodology, applications, process of solvent extraction	1
Organic reagents in Inorganic analysis - Theoretical basis for the use of organic reagents in inorganic analysis.	1
Extraction of metal ions by the use of organic reagents – acetylacetone, thionyl-trifluoroacetone, tri-n-octyl phosphine oxide.	2
Solid phase extraction- Principle, methodology, applications.	1
Numberical Problems	2
Affinity and chiral chromatography– Principle, technique, Instrumentation and applications.	1
Principles of gel – filtration Chromatography, Instrumentation	1
retention behavior, resolution, selection of gel type, applications	1
Ion exclusion– Principle and applications.	1
Instrumentation of SFC, stationary and mobile phases	2
Detectors, Advantages of SFC. Technique and applications of SFC	1
	15hrs

M.Sc. Chemistry (Final) **Semester III**

Paper CH(IC) 304T **Analytical Techniques - II (Elective IVa)**

Hour-wise Synopsis

IC-28 : Optical Methods **Dr. A.V.Aparna**

1 **CD, ORD and Fluorescence:** Introduction to fluorescence emission, principles of florescence spectroscopy, Jablonski diagram, term diagram for florescence and phosphorescene.
2 Fluorimeter – emission and excitation filters, measurement of fluorescence intensity
3 **Characteristics of fluorescence** – stoke's shift, emission wavelength is independent of the excitation wavelength, Kasha's rule.
4 **Fluorescence quenching** – Static and dynamic collisions, their comparison.
5 Fluorescence lifetime, lifetime in singlet and triplet states; Quantum yield – its importance.
6 Fluorescence polarization, anisotropy, fluorophore, polarization spectra of fluorophore.
7 Applications of fluorescence quenching (in general).
8 Fluorescence quenching studies on ligand/drug/metal complex DNA binding studies.
9 **Circular Dichroism (CD) –** Principle polarized light, polarimeter, optical rotation, circular birefringence.
10 Circular Dichroism, cotton effect – positive and negative cotton effect, Octant rule.
11 Interpretation of CD curves, comparison of CD and absorption curves.
12 Optical Rotatory Dispersion (ORD) – specific rotation, refractive indices, ORD.
13 Experimental techniques, use of CD in conformational studies of metal complexes.
14 Study on DNA and DNA-metal complexes by CD.
15 Discussion – CD, ORD and Fluorescence.

M.Sc. INORGANIC CHEMISTRY SPECIALIZATION
SEMESTER-IV

M.Sc. Final (Inorganic Chemistry) Semester IV
Paper CH(IC) 401T :Molecular Spectroscopy of Inorganic Compounds
IC -34: IC-33: Multinuclear NMR Dr. B. Sireesha
Hour-wise Synopsis

Topic to be covered	No. of hours
Theory and principle of NMR, The magnetic properties of other nuclei, ^{13}C-NMR-chemical shifts.	**1**
^{13}C-NMR continuous wave NMR: NMR recorded in frequency domain, pulsed Fourier Transform NMR, Undecoupled NMR, broad band coupled NMR. Ex: Ethyl Phenyl acetate etc.	**1**
Broad band decoupled spectra, single frequency off resonance decoupled (SFORD) NMR, Selectively decoupled NMR spectrum: principles and applications.	**1**
Factors effecting chemical shifts in^{13}C-NMR spectroscopy- diamagnetic, paramagnetic and neighbour anisotropic terms factors-hybridization, electro-negativity of substituents, steric and vander Waals effects with suitable examples.	**1**
Factors: electron deficiency – carbonium anions, mesomeric effect – Aniline, benzonitrile, intra-molecular anisotropic effects- cyclohexane and toluene, heavy atom effect, conjugation isotropic effect, hydrogen bonding, effect of pH, solvent shifts.	**1**
Chemical and magnetic equivalence definitions, examples- $H_2P_2O_5$, ethane etc. virtual coupling in cis $[Pd(P(CH_3)_3)_3\ I_2]$, $[PdI_2(PMe_3)_2)]$.	**1**
Spin dilute systems- satellites –Pt and Sn complexes low abundance active isotopes resulting in satellite peaks. NMR time scale and its uses.	**1**
Stereochemical non-rigidity: application of NMR in identifying the fluxional behavior in molecules and complexes – with examples of PF_5, $[Rh(PR_3)_5]^{5+}$, $[Fe(Cp)_2(CO)_2]$, ΔR, the ring contribution to ^{31}P chemical shifts, taking examples of phosphorous chelates.	**2**
Interpretation of ^{1}H-NMR spectral signals $[PtHCl(PEt_3)_2]$ and coupling constants, $[Pt(CH_3)_3(NH_3)_3]$ –facial and meridonial isomers, BH_4^- coupling with ^{10}B and ^{11}B, NH_4^+ coupling with ^{14}N and ^{15} N, CH_3CN.	**1**
^{1}H-NMR –spectra of $[^6h(C_7H_8Mo(CO)_3]$ and $[^7h(C_7H_7Mo(CO)_3]$, B_2H_6 – coupling with ^{11}B and $^{29}SiH_3$-SiH_3 – satellite peaks.	**1**
^{19} F-NMR spectrum of BF_4^-, (coupling with ^{11}B, ^{10}B. H_2PF_3, $J_{P-H} > J_{P-F}$ and $J_{P-F} > J_{P-H}$ spectra. ^{31}P-NMR spectrum of $Mo(CO)_3(PPh_3)_3$ – facial and meridonial isomers, $[Rh(PPh_3)_3Cl]$ Wilkinsons catalyst – JP_b-Rh, JP_b-P_a and JPa-Rh, JPa-Pb coupling.	**1**
^{31}P-NMR spectra of trans $[PtCl_4(Pet_3)_3$-satellite Peak. $^{31}PF_2H(^{15}NH_2)_2$ when $J_{P-H} > J_{P-F}$ and $J_{P-F} > J_{P-H}$ cases-interpretation of 90 line spectrum-^{13}C-NMR spectrum of $[^4hC_8H_8Ru(CO)_3]$ delocalization of electron density due to 1,2 shift.	**1**
^{13}C-NMR spectrum of iron carbonyls –$Fe(CO)_5$, $Fe_2(CO)_4$ – bridging and terminal carbonyls, $Fe_3(CO)_{12}$, $FeICp(CO)_2$, $^{13}C^{15}NCo(DMG)_2$pyridine, ^{13}C and ^{1}H- NMR & ^{13}C-NMR spectrum of bonded phenyl ligand (C_6H_5).	**1**
. Revision of the topic brief discussion of questions and Assignments Questions.	**1**
Total	**15**

M.Sc. Final (Inorganic Chemistry) **Semester IV**

Paper CH(IC) 401T **Molecular Spectroscopy of Inorganic Compounds**

Hour-wise Synopsis

IC -34: Advanced NMR techniques **Dr. A.V.Aparna**

1 Introduction to NMR – Radiofrequency region – brief description of NMR spectrometer – CW and FT-NMR; Excitation of nuclei – Absorption ; Relaxation of nuclei – emission of energy – Types of relaxation methods – Spin – lattice relaxation (T_1) and Spin-Spin Relaxation (T_2).

2 Pulse Sequences – generation of pulse, measurement of pulse, types of pulses - 90°, 180° (π – pulse), 360° pulse

3 **Spin Echo Polarization –** generation of spin echo, measurements of T_1 and T_2.

4 **^{13}C – NMR techniques:** Introduction to ^{13}C – NMR, Attached Proton Test (APT) – pulse sequences and generation of signal

5 **Distortionless Polarization Transfer (DEPT) –** pulse sequences, generation of signal.

6 **Insensitive nuclei enhanced by Polarization Transfer (INEPT):** pulse sequence and signal generation.

7 **Incredible Natural Abundance Double Quantum Transfer Experiment (INADEQUATE)** – pulse sequence and signal generation.

8 Cross Polarization – theory of cross polarization.

9 **2D – NMR:** principles of 2D – NMR, types of 2D – NMR; J-resolved Spectroscopy – Homonuclear 2D J resolved spectroscopy.

10 Heteronuclear J-resolved Spectroscopy - theory and types of Heteronuclear J-resolved spectroscopy.

11 **Correlation Spectroscopy –** Homonuclear correlation spectroscopy (COSY)

12 Heteronuclear Correlation Spectroscopy (HECTOR)

13 **Cross Relaxation –** effect of cross relaxation**.**

14 Nuclear Overhauser Enhancement Spectroscopy (NOESY), 2D heteronuclear NOE (HOESY)

15 Discussion.

M.Sc. Final (Inorganic Chemistry) **Semester IV**

Paper-I: CH(IC) 401T: Molecular Spectroscopy of Inorganic Compounds

IC-35: Applications of ESR to Metal Complexes

Hour-wise Synopsis

Dr.P.Muralidhar Reddy

Topics to be covered	No. of Hours
ESR – Introduction-Principle- Resonance Condition- Presentation of spectra-First – Derivative of Absorption curve-Selection Rules	1
ESR – Instrumentation – Klystrons – Wave guide or Wavemeter - Attenuators- Sample Cavities – Crystal Detectors and Holders- Modulation Coil-Magnetic System	1
Hyperfine splitting-Application of ESR to the study of simple free radicals: methyl ($CH3^{\cdot}$), amine ($NH2\cdot$), diphenylpicrylhydrazyl,cyclopentadienyl ($C5H5^{\cdot}$), hydroxy methyl ($CH_2OH\cdot$) radicals.	2
Zero-Field Splitting (ZFS) - Effective Spin - Orbitally Non-degenerate and Degenerate States.	1
ESR Spectra of d^1-d^9 Transition Metal Complexes with examples.	1
Interpretation of g in cubic, axial and rhombohedral geometries.	1
Factors affecting g values. Calculation of g values with simple examples. Intensities of '$g_{\parallel}$ and $g_{\perp}$peaks.	1
Application of ESR complexes - Simple free radicals – Benzene- Naphthalene- Anthracene- cyclopentadienyl anion-Tropyl radical- 1,3 – butadiene etc.	2
Evidence for Metal-Ligand Bond Covalency- Cu(II)- Bis –Salicylaldimine. $[(NH_3)_5$ Co O_2 Co $(NH_3)_5]5+$, Cu(II)- diethyldithiophosphinate, Vanadyldithiophsphinate, Copper(II) tetraphenylporphyrin, Co(II)- phthalocyanine, K2[IrCl6].	2
Interpretation of 'g' and 'A' values from ESR spectral data in- i) MnF_6^{4-}, ii) CoF_6^{4-}, and CrF_6^{3-}.	2
ESR spectra of dinuclear Cu (II) complexes.	1
	15hrs

M.Sc. Final (Inorganic Chemistry) **Semester IV**

Paper-I: CH(IC) 401T: Molecular Spectroscopy of Inorganic Compounds

IC-36: Mossbauer Spectroscopy and Nuclear Quadrupole Resonance Spectroscopy

Topics to be covered	No. of Hours
Introduction to Mossbauer Spectroscopy – general application – Principle - Mossbauer effect – Doppler broadening -	2
Instrumentation of Mossbauer Spectroscopy, details about components and experimental procedure followed and representation of spectrum	2
Isomer shit – definition and factors responsible for shift (chemical shift)	1
Quadrupole splitting – definition and cause of splitting	1
Magnetic hyperfine splitting and Selection Rules of Mossbauer spectroscopy	1
Iron Compounds: Low-spin and High-spin Fe(II) and Fe(III) Complexes –examples of Iron compounds - π-bonding Effects in Iron complexes - Study of High-spin Low-spin Cross-over – Temperatures changes	1
Diamagnetic and Covalent Compounds - Structural aspects of Iron Carbonyls - Fe $(CO)_5$ $Fe_2(CO)_9$ $Fe_3(CO)_{12}$ and Iron-Sulfur Proteins – Fe_4S_4	1
Slip test and Revision	
Tin Compounds: Tin Halides and Organotin Compounds – example like SnF_6 and $SnBr_4$, Alkyl tin compounds etc.	1
Iodine Compounds: Isomer Shifts of ^{127}I and ^{129}I - Applications to Alkali metal iodides and Molecular Iodine. Mossbauer spectra of IF^{6-} and IF^{6+}	1
Nuclear Quadrupole Resonance Spectroscopy: Principle, nuclear quadrupole resonance experiment, Structural information from NQR spectra- $PFCl_4$, PCl_4Ph, Ga_2Cl_7 - and $TeCl_4$	2
Interpretation of nuclear quadrupole coupling constants.	1
Seminar by students	1
	15hrs

M.Sc. Final (Inorganic Chemistry) **Semester IV**

Paper-II: CH(IC) 402T: Bioinorganic Chemistry

IC-37: Metal ions Interactions with Nucleic acids and their constituents

Hour wise synopsis

Dr.B.Sireesha

S.No.	Topic	Hours
1	Introduction, nucleic bases- purines and Pyrimidines, ribose and deoxyribose sugars	1
2	Nucleosides, nucleotides, structure and bonding, nomenclature	1
3	Proton binding sites of nucleic acids and constituents	1
4	Covalent structure of polynucleotides, secondary structure of DNA	1
5	Syn and anti conformations of nucleotides	1
6	B, A and Z forms of DNA, Structural features and comparison	2
7	Major grooves and minor grooves, hydrogen bonding and base pairing	1
8	General factors influencing metal ion binding in solution-basicity of bases, nature of donor atoms and metal ions, stacking of bases, indirect Chelation, kinetic factors, pH, N(7) Vs N(1) of purines, hydrogen bonding.	2
9	Stability of phosphate metal ion complexes in solution. Metal ion binding in nucleotides	1
10	Nucleotide metal ion interactions-structures	1
11	Intramolecular equibriumconstant, K_I, concept of open and closed systems, calculation of percentage of closed isomers	1
12	Outer sphere and inner sphere isomers of M-ATP complexes	1
13	Metal ion interactions with DNA and RNA, stability of nucleotide chain. Concept of T_M.	1

M.Sc. Final (Inorganic Chemistry) **Semester IV**

Paper-II: CH(IC) 402T: Bioinorganic Chemistry

IC:38 Transport of Electrons and Metal ions **Dr. B. Sireesha**

Hour wise synopsis

S.No.	Topic	Hours
1	Iron-sulphur proteins. Introduction, significance , [1Fe-0S]-rubridoxin, [2Fe-2S] and [3Fe-4S], spectral interpretation and structural aspects	2
2	Structural aspects of [4Fe-4S] and Hipip-spectral interpretation	2
3	Blue-copper proteins- types of copper in proteins and enzymes, electron transport by cytochromes, structural aspects of Azurin	1
4	Blue-copper proteins- plastocyanin in electron transport	1
5	Metal ion transport and storage; types of transport systems, gradient and channels-principles	1
6	Iron transport system- sideropores in bacteria, structure and mechanism. Transferring in mammals, transport cycle and mechanism	2
7	Structural aspects of Ferritin-Iron storage protein	2
8	Transport of Na^+ and K^+ across the cell membrane by Na^+-K^+-ATPase, mechanism	1
9	Transport of calcium across the sarcoplasmic reticulum by Ca2+-ATPase.	1
10	Revision, Seminars and slip test	2

M.Sc. Final (Inorganic Chemistry) **Semester IV**

Paper-II: CH(IC) 402T: Bioinorganic Chemistry

IC-39: Metallo-Enzymes of Iron, Zinc and Nickel

Dr. M Radhika

Hour-wise Synopsis

Topics to be covered	No. of Hrs.
Metallo-enzymes : Introduction with different examples **Iron Enzymes: Introduction**, different types of iron enzymes and their applications in short	1
Cytochrome P450: Structural aspects: geometry, ligands present around Iron, overall structure of enzyme, application and mechanism	1
Cytochrome oxidase: Structural aspects: geometry, ligands present around Iron, overall structure of enzyme, application and mechanism (Catalytic cycle)	2
Catalase and Peroxidase: Comparison of structural details, similarities and differences between Catalase and peroxidase, application and mechanism (Catalytic cycle) and Role of the Metal Ion.	1
Zinc Enzymes Introduction, different types of zinc enzymes and their applications in short, dual role of zinc ion as structural and functional role	1
Carbonic Anhydrase : Structural aspects: geometry, ligands present around zinc, overall structure of enzyme, application and mechanism (Catalytic cycle)	1
CarboxyPeptidase : Structural aspects: geometry, ligands present around zinc, overall structure of enzyme, application and mechanism (Catalytic cycle)	1
Leucin –Aminopeptidase: Structural aspects: geometry, ligands present around zinc, overall structure of enzyme, application and mechanism (Catalytic cycle)	1
Thermolysin : Structural aspects: geometry, ligands present around zinc, overall structure of enzyme, application and mechanism (Catalytic cycle)	1
Alcohol Dehydrogenase: Structural aspects: geometry, ligands present around zinc, overall structure of enzyme, application and mechanism (Catalytic cycle) and role of zinc	1
Nickel Enzymes : different types of Ni enzymes and their applications in short,	1
Urease : Structural aspects: geometry, ligands present around Ni, overall structure of enzyme, application and mechanism (Catalytic cycle)	1
Hydrogenase : Structural aspects: geometry, ligands present around Ni, overall structure of enzyme, application and mechanism (Catalytic cycle)	1
Factor F430 : Structural aspects: geometry, ligands present around Ni, overall structure of enzyme, application and mechanism (Catalytic cycle)	1

M.Sc. Final (Inorganic Chemistry) **Semester IV**

Paper-II: CH(IC) 402T: Bioinorganic Chemistry

IC-40: Metallo-Enzymes of Cobalt, Copper Molybdenum and Manganese

Hour-wise Synopsis

Dr.P.Muralidhar Reddy

Topics to be covered	No. of Hours
Cobalt Enzymes - Cobalt in Vitamin B12 – Definitions of some terms- Anaemia- Megaloblastic Anaemia- Pernicious Anaemia- Gastric Atrophy- Causes of Vit-B12 deficiency- Dietary sources of Vit –B12	1
Recommended dietary allowances (RDA)-Absorption- Storage of Vit-B12- Industrial production of Vit – B12- Excess intake of Vit-B12-Symptoms of Vit-B12 deficiency- Function of Vit-B12.	1
Discovery of Vit-B12- Natural synthesis of Vit-B12- Research- Phase-I- Phase-II and Phase - III	1
Structural Features of Vitamin B12 with reference to coordination of Cobalt - Different Oxidation States of Cobalt-Different forms of Vit-B12	1
Various forms of Vitamin B12 and Active Enzyme forms – Isomers of Vit-B12- Properties of Vit – B12r and Vit-B12s	1
Types of Reactions Catalysed by i) Methyl Cobalamin ii)DeoxyadenosylCobalamin	1
Mechanism of the Methyl Malonyl CoA conversion to Succinyl CoA by Deoxyadenosyl Cobalamin	1
Methyl Cobalamin catalyzed reactions – Homocystine to Methionine- Acetate synthetase- Methane synthetase	1
Role of the Apoenzyme - Unique features of Cobalt to suit Vitamin B12.	1
Copper Enzymes-Types of Copper in Biological Systems. Structural and Mechanistic Aspects of Superoxide Dismutase	1
Structural and Mechanistic Aspects of Laccase and Galactose oxidase	1
Molybdenum Enzymes: Biological Roles and Mechanistic Aspects of Nitrogenase – Nitrogen cycle	1
Structural and Mechanistic Aspects of Xanthineoxidase and Sulfite oxidase.	1
Manganese Enzymes: Arginase- Structure and function	1
Manganese Enzymes: Water – oxidase - Structure and function	1
	15hrs

MSc Final (Inorganic Chemistry) **Semester IV**

Paper-III: CH(IC)403T: Medicinal Inorganic Chemistry, Spectroscopic Analysis of Drug/Metal Complexes and Applications of Nanomaterials

IC-41: Metal complexes in Clinical Chemistry

Dr.Ashwini.K

Hour-wise Synopsis

Topic to be covered	**No. of hours**
Introduction to interface between biology and inorganic chemistry. Essential and non-essential elements, history of chelation therapy	**1**
Classical examples of chelation therapy-BAL, Au for Rheumatoid arthritis.Inorganic pharmaceuticals-ligand, metal, and complexes.	**1**
Theory and mode of action of therapeutic chelating agents	**1**
Single ligand chelation therapy-Pencillamine, desferoxamine,amino polycarboxylic acids	**1**
Mixed ligand chelation therapy-BAL + DMSPA and other examples.	**1**
Limitations of chelation therapy, drawbacks and newer strategies like combinatorial therapies	**1**
Metallothioneins in detoxification- structural details, donor atoms responsible for binding, mechanism for removal of toxic metals	**1**
Antibiotics, role of metal ion in enhancing the activity of BLm, Adriamycin and tetracyclins.	**1**
Structure of Bleomycin, metal binding sites and mechanism of action	**1**
Structure, activity, mode of action of adriamycin and tetracyclins	**1**
Application of Gold compounds in the treatment of rheumatoid arthritis	**1**
Menkes disease and its treatment with copper histidine complex	**1**
Role of cobalt complexes in antiviral chemotherapy	**1**
Revision of the topic dealt, slip test	**1**
Distribution of assignments, previous year question paper discussion	**1**
Total	**15**

MSc Final (Inorganic Chemistry) **Semester IV**

Paper-III: CH(IC)403T: Medicinal Inorganic Chemistry, Spectroscopic Analysis of Drug/Metal Complexes and Applications of Nanomaterials

IC-42: Metal complexes as Drugs and Anticancer agents

Dr.M.Radhika

Hour-wise Synopsis

Topics to be covered	No. of Hrs.
Introduction to Pt(II) chemistry: chemistry of Pt metal ion, stable complexes of Pt and their geometries.	1
Thermodynamic and kinetic principles – *Cis*and*Trans* influences : Stability constants , stepwise and overall stability constants,	1
Thermodynamic and kinetic aspects. Steric and electronic tuning of reactivity.: Kinetic stability, mechanism	1
Platinum complexes in cancer therapy: introduction	1
Discovery applications and structure-effect Relationships : various experiments , discovery of cis platin	1
Cisplatin(cisPt(NH3)2Cl2) mode of action. : detailed mechanism of mode of action	1
Potential binding sites on nucleic acids and their bases andproteins.: structure of DNA and its potential binding sites	1
Drug resistance and DNA repair mechanism: How the excessive use of drug becomes resistant and how to overcome the problem , DNA repair mechanism	1
Physical effects of metal complex: Cis platinbinding to DNA, conc dependent	1
DNA binding, unwinding, shortening and bending of the doublehelix: detail explanation with diagrams and examples	2
Organic intercalatorsasdonor – acceptor pairs : explanation with different examples	1
Transition metal complexes as donor acceptor pairs.: discussion in detail	1
Non classical platinum antitumour agents: different examples which contain oter ligands on Pt other than NH2 and Cl.	2

MSc Final (Inorganic Chemistry) **Semester IV**

Paper-III: CH(IC)403T: Medicinal Inorganic Chemistry, Spectroscopic Analysis of Drug/Metal Complexes and Applications of Nanomaterials

IC-43: Spectroscopic analysis of drug/metal complexes binding to DNA

Dr.Ashwini.K

Hour-wise Synopsis

Topic to be covered	**No. of hours**
Introduction to absorption spectroscopy, fluorescence spectra , its uses to study structural properties of DNA, fluorescence titrations	**1**
DNA and Drug binding equations, types of drug binding-intercalation and groove binding	**1**
Scatchard, hounston and klontz plots and their interpretation	**1**
Cooperativity in drug binding to DNA, anticooperativity, binding isotherms for cooperativity and anticooperativity	**1**
Excluded site model-anticooperativity, stereochemical hinderance etc, fluorescence quenching studies	**1**
Salt back titrations-salt concentration dependence of formation constant of drug/metal complex with DNA	**1**
Binding analysis-obtaining equilibrium binding analysis and interpretation of binding isotherms	**1**
Effect of cations on nucleic acid equilibrium- effect of monovalent and divalent cations on DNA binding and ratios of binding	**1**
Record's polyelectrolyte theory and its importance in binding to DNA and RNA polyanions	**1**
Dialysis experiment-experimental setup, equilibrium dialysis experiment, analysis of different forms of DNA-A,B, Z forms, base , sequence specific binding of drug or metal complex	**1**
Viscosity studies—experimental setup-ostwalds viscometer, change in the viscosity of DNA solution on drug /metal complex binding	**1**
Structure of different forms of DNA, supercoiled , nicked, linear forms	**1**
Gel electrophoresis-experimental requirements, analysis of DNA based on movement in gel electrophoresis	**1**
Revision of the topic dealt, slip test	**1**
Seminars, Assignment allotment, previous years question paper discussion	**1**
Total	**15**

MSc Final (Inorganic Chemistry) **Semester IV**

Paper-III: CH(IC)403T: Medicinal Inorganic Chemistry, Spectroscopic Analysis of Drug/Metal Complexes and Applications of Nanomaterials

IC-44: Applications of Nanomaterials

Dr.S.Sreekanth

Hour-wise Synopsis

Topics to be covered	No. of Hours
Introduction to Nanotechnology and its advantages and scope, Top-Down approach, Bottom-Up approach	1
Application of Nanotechnology in the field of electronics – Nano electronics Semiconductors, Transistors, Moore's Law, computer chips, CMOS, RTD and SET	2
Application of Nanotechnology in the field of biology -	1
Consumer and domestic applications of nanothechnology – biological motors, protein detectors, biology inspired nano applicaiton	1
Energy related application: photo-volatile cells, Energy storage nanomaterials – Solar cells – Type of cells - DSSC	1
Slip test and Revision	1
Introduction to sensors and Application in Agriculture -	1
Application of Sensors in Health, Medical and food security	1
Introduction to biosensor and there types – Composition of sensor – Applications	1
Applied nanobiotechnology and Bioimaging	1
Nanobiomedical science and its application in drug delivery and drug targeting – Cancer therapy, cancer detection,	2
Neutron capture therapy – Boron	1
Seminar by students	1
	15hrs

M.Sc. Final (Inorganic Chemistry) **Semester IV**

Paper CH(IC) 404T (Elective IVa) **Interdisciplinary Course**
Environmental and Applied Analysis

Hour-wise Synopsis

IC -49: Clinical and Pharmaceutical Analysis **Dr. A.V.Aparna**

1 Introduction to clinical and pharmaceutical analysis, importance of the analyses. Determination of Sulphanilamide by potentiometry – principle and estimation.

2 Estimation of Diclofenac by Non-aqueous titrations – non-aqueous titrations, types of solvents used, principle and estimation; Determination of calcium in tablets by comlpexometry – theory of complexometric titrations, EDTA as chelating agent and estimation of calcium.

3 Estimation of Pethidine Hydrochloride and Frusemide by UV-Vis Spectroscopy – Principle of UV-Vis spectroscopy, λ_{max} and estimation.

4 Estimation of Aspirin, paracetamol and codine in APC tablets by NMR – brief discussion about NMR, NMR spectrum and detection based on chemical shift values. Estimation of Phenobarbitone in tablets by IR – principle of IR, Functional group frequencies, IR spectrum and assignment of group frequencies.

5 Determination of pivolic acid in dipivefrin eye drops by GC – Principle of GC, Quantitative analysis – Internal standard method – estimation

6 Estimation of Hydrocortisone by HPLC – principle of HPLC, mobile phases, peparation of cream extract, estimation.

7 Impurity profiling of Propranolol by GC-MS and Famotidine by LC-MS: Hyphenated techniques, interfaces used in GC-MS and LC-MS, detection.

8 Clinical Analysis – Analysis of carbohydrates – carbohydrates, significance classification, , Glucose –fasting, random and post-pandrial. Glucose estimation by colorimetry.

9 Analysis of Protiens – definition and importance of proteins, estimation of proteins by Biuret method.

10 Lipids and their significance, cholesterol – HDL, LDL, determination of cholesterol – Zatkin's, Zak and Boyle method.

11 Metabolites – significance of metabolites, blood urea – importance and estimation.

12 Heteronuclear Correlation Spectroscopy (HECTOR)

13 Analysis of ions – importance of Na, K, Ca – their determination by flame photometry – principle and brief description about the instrument.

14 Importance and determination of bicarbonates and phosphates.

15 Harmones - Radio Immuno Assay (RIA) and ELISA - Enzyme Linked Immuno Sorbent Assay

M.Sc. Final (Inorganic Chemistry) **Semester IV**

Paper-IV: CH(ID) 404T: Interdisciplinary Course (Environmental and Applied Analysis)

IC-50: Food and Agricultural analysis

Hour-wise Synopsis **K.Sudeepa**

Topics to be covered	No. of Hours required
Introduction to applied Analysis: Introduction to Chemical analysis, role of chemical analysis in daily life , purpose of food and agricultural analysis.	1
Role of analytical methods adopted in analysis, principles and theory of titrimetry, principles of Instrumental methods.	1
Analysis of chemical additives: Definition of additive, colour additives, and its classification, Health hazards of dyes,Procedure for extraction of added dyes from sample.	1
Assay of dyes in foods: Role of separation techniques in the analysis. Sample clean up, extraction of dye, analysis of dye by Qualitative and Quantitative techniqes.	1
Chemical preservative: Definition of preservatives, Examples of preservatives natural and chemical preservatives, role of preservatives in products. Assay of Sodium benzoate, Examples of foods containg the sodium benzoate, extraction of preservative by solvent extraction and its assay.	1
Sorbic acid ,SO_2&Benzoic acid:,sorbic acid, Extraction of sorbic acid from food product,assay of sorbic acid, Examples of foods containg the SO_2, assay of sulphurdioxide by adopting Examples of foods containg the different techniqes.Examples of foods containg the Benzoic acid, Assay of Benzoic acid by UV.	1
Antioxidants: Definition, Examples of foods containg antioxidants, role of antioxidants, examples, Principle and Instrumentation of GC and assay of gallates, Assay by TLC, BHT, examples of foods containg BHT, Sample extraction, and its assay.	1
Food Adulteration: Definition, Purpose of Adulteration, List of common adulterants, Effect of Adulterants on health and microscopic examination.	1
Analysis of Soil: Constituents of Soil, importance of soil assay, sample collection, role of the nutrients in soil, types of soils.	1
Parameters in soil: Definition of pH and its effect on soil, glass membrane electrode, calibration of ph meter, Soil sample preparation and its assay, Conductivity- definition, ions responsible for conductivity, calibration of instrument and its measurement.	1
Assay of total organic matter, Assay of Nitrogen, Assay of micronutrients and toxic elements in soil by AAS- principle, preparation of soil sample, standards.Cation exchange capacity.	1
Assay of fertilizers: Background theory for fertilizers assay,assay of potassium - flame photometry principle, preparation of standards,Assay of phosphorus by bray and kutzmethod order.Micronutrients and its significance,Assay by AAS. **Assay of Pesticides**: Definition, role of pesticides, assayoforganochloro pesticide, structure, Gc instrumentation, sample preparation.	2
Determination of Malathion- structure, sample preparation, sample clean up, assay. Methyl parathion and DDT residues in vegetables and food grains- structure, sample preparation, sample clean up and assay.	1
Revision	1
	15hrs

M.Sc. Final (Inorganic Chemistry) **Semester IV**

Paper-IV: CH(ID) 404T: Interdisciplinary Course (Environmental and Applied Analysis)

IC-51: Analysis of Air and Water Pollutants

Hour-wise Synopsis **Kavitha Ramdas**

1. Introduction to air pollutants and analysis, air quality standards, sampling methods- equipments and containers used.
2. Analysis of SO_2 in air samples by UV-visible and IR spectroscopic methods.
3. Analysis of H_2S by UV -visible spectrophotometry and Non-dispersive IR spectrophotometry.
4. Analysis of NO-NOx by chemiluminescence technique and colorimetric technique- Saltzman method.
5. Analysis of CO & CO_2 by IR, AAS & GC. Analysis of hydrocarbons by GC and GC-MS methods.
6. Aromatic hydrocarbons in automobile exhaust, petrol, air.
7. Analysis of Ozone by chemiluminiscence and spectrophotometry and particulate matter analysis.
8. Introduction to water pollutants and analysis.
9. Objectives of water analysis, sampling methods, preservation and pre-concentration methods.
10. Physical analysis - colour, odour, temperature, pH, EC, redox potential, total dissolved solids (turbidimetry).
11. Chemical analysis of anions – CN^-, Cl^-, F^-, NO_2^- and NO_3^- ions by spectrophotometric method.
12. Analysis of SO_4^{-2} and PO_4^{-3} ions. Determination of dissolved oxygen in water sample.
13. Determination of BOD, COD and TOC in water samples.
14. Analysis of toxic metals: Hg, As, Pb by Atomic absorption spectroscopy and UV-visible spectrophotometry.
15. Analysis of Cd, Be, Al and Cr by Atomic absorption spectroscopy and UV-visible Spectrophotometry.

M.Sc. Final (Inorganic Chemistry) **Semester IV**

Paper-IV: CH(ID) 404T: Interdisciplinary Course (Environmental and Applied Analysis)

IC-52: Drinking Water and Sewage Water Treatment

Hour-wise Synopsis

Dr.P.Muralidhar Reddy

Topics to be covered	No. of Hours
Hardness: causes, measurement of hardness, Degree of hardness, units- types of hardness – parts per million, milligrams per litre, Degree clark, Degree French-conversion of hardness	1
Estimation of temporary and permanent hardness, Alkalinity of water and its estimation.	1
Treatment of Water for Municipal Supply: Characteristics of potable water/Domestic water,	1
WHO standards and Indian Standards.	1
Water for Domestic use and Treatment of Water for Municipal Supply - Aeration, Sedimentation with coagulation, Filtration, Sterilization and Disinfection:	1
Physical Methods-Boiling, Exposure to Sunlight, Disinfection with UV light, Chemical Methods – Ozonization, Chlorination, Breakpoint chlorination and Dechlorination.	1
Desalination of Brackish Water: Treating saline water: distillation, electrodialysis, reverse osmosis (RO).	2
Mineral Water and Purified Water - Typical Manufacturing Process, Flow Sheet Diagram of Mineral Water Manufacturing Process,	2
Purified Water-Purification methods-Distillation, Double distillation, Deionization - Co-current deionization, Counter-current deionization, Mixed bed deionization	1
Demineralization, Uses of purified water- Laboratory use, Industrial uses and other uses; Health effects of drinking purified water	1
Sewage Water Treatment: Domestic sewage - Physical, Chemical, and Biological Characteristics of Domestic Sewage, Municipal sewage	1
Sewage Composition and Contaminants and Sewage Treatment	1
Sewage Treatment - On-Site Sewage Treatment Systems and Off-Site Sewage Treatment Systems	1
	15hrs