DETAILED SYLLABUS M.Tech

NAME OF DEPTT./ CENTRE: **DEPARTMENT OF CHEMISTRY**

1. Subject Code: **CYN-711** Course Title: **Lab - I**

2 Contact Hours: **L: 0** **T: 0** **P: 8**

3. Examination Duration (Hrs.): **Theory** 0 **Practical** **6**

4. Relative Weightage**: CWS 0 PRS 25 MTE 25 ETE 0 PRE 50**

5. Credits**:** **4** 6. Semester**: Autumn** 7. Subject Area**: PCC**

8. Pre-requisite**: Nil**

9. Objective: To develop experimental skills in different methods of characterization.

10. Details of Course:

S. No.	Contents
	List of Experiments:
1.	Simultaneous polarographic determination of two metal ions.
2.	Polarogaphic estimation of colouring matters in food and dyes.
3.	Use of atomic absorption spectroscopy in the estimation of metal contents in samples.
4.	Experiment based on the use of radiotracers, and radioactivity measurements.
5.	Experiment on separation and estimation of organic compounds using gas chromatograph.
6.	Multi-step synthesis and characterization of pharmaceutical drug.
7.	Analysis of organic components in a mixture by HPLC.

11. Suggested Books:

S. No.	Authors/ Books/ Publisher	Year of Publication/Reprint
1.	Willard H.H. Merritt L.L., Dean J.A. and Settle F.A., "Instrumental Methods of Analysis",7th Ed., Wadsworth Publishing Co.	**1988**
2.	West A.R., "Solid State Chemistry and its Applications", John Wiley & Sons	**1988**
3.	Arnikar H.J., "Essentials of Nuclear Chemistry", Wiley-Eastern	**1990**
4.	Skoog D.A., Holler F.J. and Crouch S.R., "Principles of Instrumental Analysis", 6th Ed., Thomson Brooks	**2007**

NAME OF DEPTT./CENTRE: **DEPARTMENT OF CHEMISTRY**

1. Subject Code: **CYN-721** Course Title: **Analytical Methods**

2. Contact Hours: **L: 3** **T: 0** **P: 0**

3. Examination Duration (Hrs.): **Theory** 3 **Practical** 0

4. Relative Weight**:** **CWS** 25 **PRS** 0 **MTE** 25 **ETE** 50 **PRE** 0

5. Credits**:** **3** 6. Semester**: Autumn** 7. Subject Area**: PCC**

8. Pre-requisite**: Nil**

9. Objective: To impart advanced knowledge of different methods of analysis as applied in industry and research.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	**Chromatographic Methods:** General principles of chromatography, retention, resolution and separation factor, place concept, van Deemter equation, chromatographic column and detector characteristics; applications in quantitative analysis-Kovat's index; High Performance Liquid Chromatography (HPLC)- instrumentation, separation columns, detectors, interfacing with Gas Chromatography (GC) and HPLC with mass spectrometry; Reverse phase chromatography; Ion chromatography- its comparison with ion exchange, applications; Inorganic ion exchangers- their classification and application in radioactive waste processing; Affinity chromatography and gel filtration chromatography- basic principles and applications.	**12**
2.	**Electroanalytical Methods and Sensors:** Voltametric, coulometric methods; Principle, instrumentation, analytical applications of polarography, pulse and differential pulse polarography, cyclic voltammetry and alternating current cyclic valtammetry, chronopotentiometry, anodic and cathodic stripping voltammetry, microelectrodes, modified electrodes and their analytical applications, electo-separations at controlled potential; Membranes, electroactive materials, membrane potential, selectivity coefficients and their determination, discussion of some important ion and molecule sensors, applications.	**12**
3.	**Nuclear Analytical Methods:** Basic principle of methods based on radioactivity measurements, choice of radiotracers, advantages and limitations; Activation methods- neutron activation methods, principle, classification, methodology, instrumentation, multi-elemental and nondestructive character, interferences, cyclic and derivative activation analysis, typical applications for trace element analysis of various matrices, isotope dilution analysis (IDA) using radiotracers and stable isotopes (ID-MS), basic principle and methodology, limitations, comparison with neutran activation analysis (NAA),	**12**

	substoichiometric IDA; Other radiometric methods using radio-reagents, radiometric titration, radio-chromatography, radioimmunoassay, their advantages and applications; Radio isotopes in diagnosis and therapy.	
4.	**Automation in Analysis:** Requirements of automation, automatic and automated devices, continuous and discrete analyzers, feedback control loop, on-line analyzer, automated process control, non-destructive automatic analyzer, automation in clinical, environmental analysis and quality control, automated elemental analyzers, laboratory robots.	**6**
	Total	**42**

11. Suggested Books:

S. No.	Authors/ Books/ Publisher	Year of Publication/ Reprint
1.	Willard H.H., Merritt L.L., Dean J.A. and Settle F.A., "Instrumental Methods of Analysis", 7th Ed., Wardsworth Publishing Co.	**1988**
2.	Vandecasteele C. and Block C.B., "Modern Methods of Trace Element Determination", John Wiley & Sons	**1993**
3.	Ehmann W.D. and Vance D.E., "Radiochemistry and Nuclear Methods of Analysis", John Wiley & Sons	**1991**
4.	Skoog D.A., Holler F.J. and Nieman T.A., "Principles of Instrumental Analysis" 5th Ed., Harcourt Brace & Company	**2006**
5.	Meites, L., "Polarographic Techniques", Interscience Publisher,	**2001**

NAME OF DEPTT/CENTRE: **DEPARTMENT OF CHEMISTRY**

1. Subject code: **CYN-731** Course Title: **Characterization Techniques**
2. Contact Hours: **L: 3** **T: 0** **P: 0**
3. Examination Duration (Hrs): **Theory:** 3 **Practical:** 0
4. Relative Weightage: **CWS:** 25 **PRS:** 0 **MTE:** 25 **ETE** 50 **PRE:** 0
5. Credits: 3 6. Semester: **Autumn** 7. Subject Area: **PCC**
8. Pre-requisite: Nil
9. Objective: To impart knowledge on characterization techniques used in industries and R&D
10. Details of the Course:

S. No.	Contents	Contact Hours
1.	X-Ray: Concept of X-ray spectra; detection of X-ray; absorption methods- absorption law, absorption edge analysis; X-ray emission spectroscopy – direct method, X-ray fluorescence method, energy dispersive and wavelength dispersive method; X-ray diffraction- concept of lattice, space groups, crystalline state, types of crystal system, scattering of X-ray, amplitude and phase of diffraction, structure factors, experimentation – powder method, indexing, unit cell parameters, characterization of crystalline materials; single crystal method, interpretation of diffraction data, calculation of structure factor, electron density maps and structure determination, R-factors and applications.	10
2.	Surface Characterization: X-ray photoelectron spectroscopy – chemical shift, instrumentation, qualitative and quantitative analysis, electron spectroscopy for chemical analysis, scanning electron microscopy – principle of electron matter interaction, instrumentation and use of energy dispersive x-ray analysis; transmission electron microscopy – reciprocal space and lattice, Ewald sphere, diffraction from crystal, bright and dark field imaging, indexing of diffraction pattern; Auger electron spectroscopy; Atomic force microscopy – concepts and instrumentation; Scanning probe microscopy – concepts and instrumentation.	9
3.	Thermal Method: Instrumentation on thermogravimetric analysis (TGA); differential thermal analysis (DTA); differential scanning calorimeter (DSC); use of thermal methods for characterization of materials.	4
4.	**Mass spectroscopy**: Instrumentation, types of ion sources, mass analyzers, resolution, nitrogen rule, ring rule, McLafferty's rearrangement, interpretation of mass spectrum, hyphenated techniques (GC-MS and LC-MS).	7
5.	**Nuclear magnetic resonance**: instrumentation, FT-NMR spectrometer, Chemical shift, spin- spin coupling, spin- spin decoupling, 1-H and 13-C-NMR, and 2D-NMR, 1-H and 13-C NMR, 2D-NMR, Data interpretation, Zeugmatography and biological applications.	7
6.	**EPR Spectroscopy**: Principle and instrumentation, g-values and hyperfine coupling, spin densities and McConnell relation, Interpretation of organic radicals; spectra of inorganic complexes, zero field splitting and Krammers degeneracy, anisotropy in the hyperfine coupling constant, single crystal EPR nuclear quadrupole interaction, spectral interpretation of transition metal complexes; General introduction to double resonance experiments, ENDOR, ELDOR, biological applications.	5

	Total	**42**

11. Suggested Books:

S. No.	Name of Authors/Book/ Publisher etc.	Year of Publication/ Reprint
1	Ewing G.W., "Instrumental Methods of Chemical Analysis", 5th Ed., McGraw Hill.	2004
2	Skoog, D.A., West D.M., Holler F.J. and Crouch S.R., "Fundamentals of Analytical Chemistry" 8th Edition, Thomson Brooks/Cole.	2004
3	West A.R., " Solid State Chemistry and its Applications", John Wiley & Sons	2002
4	Williams D.B. and carter C.B., "Transmission Electron Microscopy: A textbook for Materials Science, 2nd Edition, Springer.	2003
5	Goldstein, J., Newbury, D.E., Joy, D.C., Lyman, C.E., Echlin, P., Lifshin, E., Sawyer, L and Michael J.R., " Scanning Electron Microscopy and X-Ray Microanalysis", 3rd Edition, Springer 2003	2003
6.	Slichter C.P., "Principles of Magnetic Resonance" Springer Verlag	1981
7	Parish, R.V., "NMR, NQR, EPR and Mossbauer Spectroscopy in Inorganic Spectroscopy", Ellis Horwood Limited, 1st Ed.	1990
8	Banwell C.N. and Mc Cash E. M., "Fundamentals of Molecular Spectroscopy" Tata Mc Graw Hill, 4th Edition, 1998, 30th reprint.	2008
9	Drago, R. S., "Physical Methods for Chemists" Saunders College Publishing, 2nd Edition	1992

NAME OF DEPTT./CENTRE: **DEPARTMENT OF CHEMISTRY**

1. Subject Code: **CYN-741** Course Title: **Chemometrics and Modelling**

2. Contact Hours: **L: 3** **T: 0** **P: 2**

3. Examination Duration (Hrs.): **Theory** 3 **Practical** 0

4. Relative Weightage**:** **CWS** 15 **PRS** **25** **MTE** 20 **ETE** 40 **PRE** 0

5. Credits**:** **4** 6. Semester**: Autumn** 7. Subject Area**: PCC**

8. Pre-requisite**: Nil**

9. Objective: **T**o import knowledge of modern methods of reducing and analyzing chemical data.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	**Fundamentals, probability and statistics:** Representation of simultaneous equations in matrix form, scalars, vectors and matrices; The matrix inverse, eigenvalues and eigenvectors, false negatives, false positives and power in testing of means; Regression (linear and nonlinear regression, curve fitting of chemical models, chemical calibration to concentration and properties, signal processing (digital filters, derivative filters, noise, Fourier transforms).	**14**
2.	**Treatment of Data*:*** Sources of error, precision and accuracy, propagation of errors (random errors, systematic errors, correlated errors), distributions (binomial distribution, sampling of solids, Poisson distribution, shot noise, gaussian distribution, chi-squared distribution, Student t distribution, confidence intervals), hypothesis testing (t-test, types of errors, paired t-test, F-test, chi-squared test, Q-test), simple analysis of variance and experimental design (one-way, two-way with and without replicates, randomized and blocked designs).	**14**
3.	**Computational methods:** Introduction to digital computers, representation of numbers, errors in floating point representation; Algorithms, syntax of one higher level language suitable for scientific computations (C or Fortran)-declarations, assignment statement, input/ output statements, control structures for selection and iteration, functions, array data structure, selected numerical methods for data analysis and treatment, writing and implementation of simple programs and one individually assigned programming project.	**14**
	Total	**42**

List of Practicals:

I. Writing C program using input and output statements
II. Writing C program to demonstrate the concept of scope of variables
III. Writing C program involving functions
IV. C program for analysis of errors
V. C program for least square analysis
VI. Geometry optimization of small molecules using Gaussian 09 program

VII. Calculation of IR frequencies of sample using Gaussian 09 program
VIII. Computation of excitation energies for small molecules using Gaussian 09 program
IX. Conformational analysis using molecular modeling
X. C programming projects involving chemical calculations

Suggested Books:

S. No.	Authors/ Book/ Publisher	Year of Publication/ Reprint
1.	Balagurusamy E., "Programming in ANSIC", Tata McGraw-Hill.	2004
2.	Anderson R.L., "Practical Statistics for Analytical Chemists", John Wiley.	1970
3.	Brereton R.G., "Applied Chemometrics for Scientists", John Wiley.	2007
4.	Goyal M., "Comprehensive Computer Based Numerical and Statistical Techniques", Laxmi Publications (P) Ltd.	2006
5.	Miller J.N. and Miller J.C., "Statistics and Chemometrics for Analytical Chemistry", Pearson Education Limited	2005

NAME OF DEPTT./CENTRE: **DEPARTMENT OF CHEMISTRY**

1. Subject Code: **CYN-712** Course Title: **Lab - II**

2. Contact Hours: **L: 0** **T: 0** **P: 8**

3. Examination Duration (Hrs.): **Theory** 0 **Practical** 6

4. Relative Weightage**:** **CWS** 0 **PRS** 50 **MTE** 0 **ETE** 0 **PRE** **50**

5. Credits**:** **4** 6. Semester**: Spring** 7. Subject Area**: PCC**

8. Pre-requisite**:** **Nil**

9. Objective: To develop experimental skills in modern methods of characterization.

10. Details of Course:

S. No.	Contents
	List of Practicals
1.	Use of IR spectroscopy in determination of the purity of commercial samples
2.	Thermal decomposition studies of inorganic compounds and polymers
3.	Magnetic measurements by vibrating sample magnetometer (VSM).
4.	Powdered x-ray diffraction pattern of a cubic/tetragonal system and indexing of the pattern (a) Determination of unit cell parameter. (b) Determination of number of molecules in a unit cell. (c) Identification of materials in a solid mixture by powder x-ray diffraction pattern.
5.	Preparation, characterization and photodegradation by ZnO nanoparticles
6.	Study of flow behavior of different kind of viscous materials using rheometer
7.	Determination of Caffeine in beverages by HPLC/ LC-MS
8.	Synthesis of organic compounds and NMR studies

11. Suggested Books:

S. No.	Authors/ Book/ Publisher	Year of Publication/ Reprint
1.	Radd M. and Palmer R. "Structure Determination by X-ray Crystallography", 4th Ed., Springer.	**2003**
2.	Willard H.H., Merritt L.L., Dean J.J. and Settle F.A., "Instrumental Methods of Analysis", 7th Ed., Wadsworth Publishing Co.	**1988**
3.	Skoog D.A., Holler F.J. and Crouch S.R., "Principles of Instrumental Analysis", 6th Ed., Thomson Brooks.	**2007**
4.	Ewing G.W., "Instrumental Methods of Chemical Analysis**",** 5th Ed**.,** McGraw-Hill**.**	**2006**

NAME OF DEPTT./CENTRE: **Department of Chemistry**

1. Subject Code: **CYN-722** Course Title: **Pharmaceutical Organic Synthesis**
2. Contact Hours: **L: 3** **T: 0** **P: 0**
3. Examination Duration (Hrs.): **Theory** **3** **Practical** **0**

4. Relative Weightage**: CWS** **25** **PRS 0** **MTE** **25** **ETE** **50** **PRE** **0**
5. Credits**:** **3** 6. Semester**: Spring** 7. Subject Area**: PEC**
8. Pre-requisite**: Nil**
9. Objective: To provide an advanced knowledge of organic synthesis required in pharmaceuticals.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	**Biosynthesis vs Laboratory Synthesis:** Involvement of Nucleic acids, amino acids, carbohydrates and lipids as drug targets, Differences between laboratory synthesis and biological synthesis, Mechanisms in Biological chemistry*:* reductive amination, Michael addition, rearrangements, Shikimate pathway, Secondary metabolites and their applications in pharmaceutical industry.	**6**
2.	**Strategies in Organic synthesis of drugs:** Disconnection approach, applications in 1,1-, 1,2-, 1,3-and 1,5-difunctionalized compounds, recognition of high yielding steps and recognizable starting materials, biomimetic approach to retrosynthesis, Application of the disconnection strategies to the synthesis of Propoxycaine, Dinocap, (+)Disparlure, Retronecene, Longifoline.	**8**
3.	**Green chemistry approach:** Principal. Atom economy and scope, Introduction to alternative approaches, solvent free reactions-principal, scope, utility, organic synthesis in solid state, solid supported organic synthesis-synthesis of aziridines, pyridines, chromenes and flavones, aqueous phase reactions: Diels Alder, Heck reaction, epoxidation, Microwave technology: equipment, activation benefit, limitations, microwave effects in synthesis, Microwave assisted solid phase reactions, neat reactions, microwave assisted reactions under PTC conditions, ultrasound assisted reactions: Principal, benefits and limitations, ultrasound assisted substitution, addition, oxidation and reduction reactions, Organocatalysis: Aldol reaction, acyl transfer reactions, setter reaction, Bakers yeast, N-heterocyclic carbenes, Ionic liquids: introduction and application in organic synthesis.	**14**
4.	**Total synthesis**: Corey's synthesis of prostaglandins and paeoriflorin, Sharpless synthesis of L-hexoses, Nicolaous synthesis of Taxol, Danishefsky synthesis of indolizomycin, Takasago synthesis of menthol, Hoffmann-LaRoche synthesis of Biotin.	**6**
5.	**Scaffolds in Pharmaceutical Synthesis:** Diversity in pharmaceutical scaffolds, diversity oriented synthesis; synthesis, reactivity, aromatic character and importance of pyridazine, pyrazine, benzimidazole, benzoxazole, 1,2,3-triazines, tetrazole, 1,3,4-thiadiazole, tetrazines, pteridines.	**8**
	Total	**42**

11. Suggested Books:

S. No.	Authors/ Title/ Publisher	Year of Publication
1.	**Katritzky, A.R. and Pozharskii, A.F., "Handbook of Heterocyclic Chemistry"Pergamon, 2nd Ed.**	**2000**
2.	Mann, J. "Secondary metabolism", Oxford chemistry series	**1987**
3.	Total Synthesis of Natural Products by Apsimon Vol 1-5.	**2013**
4.	Organic synthesis-The disconnection approach by S Warren	**2008**
5.	Classics in Total Synthesis K. C. Nicolaou and E. J. Sorenson	**1996**
6.	Green Chemistry, Theory and Practical, Paul T Anastas and John C. Warner	**2000**

NAME OF DEPTT./CENTRE: **Department of Chemistry**

1. Subject Code: **CYN-732** Course Title: **Environmental Chemistry**

2. Contact Hours: **L: 3** **T: 0** **P: 0**

3. Examination Duration (Hrs.): **Theory** 3 **Practical** 0

4. Relative Weightage**: CWS 25 PRS 0 MTE 25 ETE 50 PRE 0**

5. Credits**:** **3** 6. Semester**: Spring** 7. Subject Area**: PEC**

8. Pre-requisite**: Nil**
9. Objective: To provide knowledge of environment chemistry.
10. Details of Course:

S. No.	Contents	Contact Hours
1.	**Chemistry and the Environment:** Environment segments, ecosystem and natural cycles of the environment, chemical and photochemical reactions in the atmosphere, ozone chemistry, oxides of sulphur and nitrogen, organic compounds, green house effect and global warming, acid rain, environmental fate of pollutants, biological activity, biodegradation of carbohydrates, fats and oil, proteins, detergents, pesticides.	**9**
2.	**Chemical Toxicology:** Toxic chemicals in the environment, toxic effects, biochemical effects of arsenic, cadmium, lead, mercury, copper, chromium; Biochemical effects of some gaseous pollutants, cyanide, pesticides, asbestos.	**6**
3.	**Pollution:** Air pollutants, air quality standards, sampling and analysis, air pollution control, noise pollution, injurious effects of noise.	**3**
4.	**Water Quality:** Water quality parameters and standards, turbidity, color, pH, acidity, solids, hardness, chlorides, residual chlorine, sulfates, fluorides, phosphates, iron, manganese, nitrogen, DO, BOD, COD, grease, volatile acids, analytical techniques in water analysis, soil pollution.	**9**
5.	**Wastewater Treatment:** Primary treatment, equalization, neutralization, proportioning, sedimentation, oil stripping of volatile organic, biological treatment process, lagoons, activated sludge process, trickling filtration, anaerobic decomposition, sludge handling and treatment process.	**9**
6.	**Adsorption and Oxidation Processes:** Theory of adsorption, ion exchange process, chemical oxidation, advanced oxidation process, miscellaneous treatment processes.	**6**
	Total	**42**

Suggested Books:

S. No.	Authors/ Book/ Publisher	Year of Publication/Reprint
1.	De A.K., "Environmental Chemistry", 7th Ed. New Age International (P) Ltd.	**2010**
2.	Sawyer C.N., "Chemistry for Environmental Engineering", 4th Ed., McGraw, Inc.	**1994**
3.	Metcalf E., "Wastewater Engineering", 3rd Ed., McGraw Hill Inc.	**1991**
4.	Manahan S.E., "Environmental Chemistry", 8th Ed., CRC Press.	**2005**
5.	Masters G.M., "Introduction to Environmental Engineering and Science", Prentice Hall of India Pvt. Ltd.	**1998**
6.	Khopkar S.M., "Environmental Pollution Analysis", New Age International (P) Ltd.	**2008**

NAME OF DEPTT./CENTRE: **Department of Chemistry**

1. Subject Code: **CYN-742** Course Title: **Analysis of Materials**

2. Contact Hours: **L: 3** **T: 0** **P: 0**

3. Examination Duration (Hrs.): **Theory** 3 **Practical** 0

4. Relative Weightage**: CWS 25 PRS 0 MTE 25 ETE 50 PRE 0**

5. Credits**:** **3** 6. Semester**: Spring** 7. Subject Area**: PEC**

8. Pre-requisite**: Nil**
9. Objective: To provide advanced knowledge of chemistry of engineering materials and their analysis.
10. Details of Course:

S. No.	Contents	Contact Hours
1.	**Steel, Ferro and Non-Ferro Alloys:** Analysis of major constituents such as combined and uncombined carbon and silicon; Analysis of various metals present in steel, ferrochrome, ferromanganese, ferrovanadium, ferromolybdenum and ferrotungsten; Systematic determination of various metal ions in non-ferro alloys, analysis of major constituents in brasses, bronzes, gun metal and white metal.	**10**
2.	**Analysis of Constituents of Mortar and Concrete:** Classification of cements, various constituents of cement; Analysis of Portland cement with reference to insoluble residue, total silica, sesquioxides, iron, lime and manganese.	**6**
3.	**Analysis of Paints:** Identification of thinner, vehicle and their analysis, classification of pigments, analysis of various constituents in different pigments, varnishes, catalyzed coating and metal manganese.	**6**
4.	**Oils, Lubricants and Greases:** Testing of lubricating and allied oils with reference to viscosity and viscosity index, cloud and pour points, flash and fire points, aniline points, neutralization number, total acid number, Koettsdoerfer number and iodine value; Mechanical stability of greases, determination of penetration number and dropping point of grease, analysis and characterization of petroleum products.	**10**
5.	**Detergents:** Various constituents of detergents, quantitative analysis of anionic, cationic, amphoteric, ampholytic and zwitterionic surfactants; Determination and identification of major organic components such as sodium carboxymethyl cellulose, NTA, EDTA, organic bleaches and inorganic constituents; Analysis of soap products.	**10**
	Total	**42**

Suggested Books:

S. No.	Authors/ Book/ Publisher	Year of Publication/ Reprint
1.	Agarwal B.C. and Jain S.P., "Metallurgical Analysis", Khanna Publications.	**1996**
2.	Virmani O.P. and Narula A.K., "Applied Chemistry: Theory and Practice", New Age International Publishers.	**2001**
3.	Longman G.F. "The Analysis of Detergents and Detergent Products", John Wiley and Sons.	**2000**

NAME OF DEPTT./CENTRE: **Department of Chemistry**

1. Subject Code: CYN-752 Course Title: Analysis of Food and Drugs

2. Contact Hours: **L: 3** **T: 0** **P: 0**

3. Examination Duration (Hrs.): **Theory** **3** **Practical** **0**

4. Relative Weightage**: CWS 25 PRS 0 MTE 25 ETE 50 PRE 0**

5. Credits**:** **3** 6. Semester**: Spring** 7. Subject Area**: PEC**

8. Pre-requisite**: Nil**
9. Objective: To provide knowledge of composition and analysis of foods and drugs.
10. Details of Course:

S. No.	Contents	Contact Hours
1.	**Analysis of Basic Constituents of Food:** Moisture in case of dry, wet, moist food, oils, fat and fatty emulsions in case of fatty foods, volatile oil in case of spices, fibre determination in fibre containing food such as cereal, bread, spices (to determine quality of spices), protei in all kinds of food; Ash-determination of sulfated ash, water soluble ash and siliceous matter in vegetables, spices, sugars in fruit juices and soft drinks, acidity and volatile acidity, pH value.	**10**
2.	**Analysis of Preservatives, Colouring Matter and Contaminants:** Determination of SO_2, benzoic acid, hydroxyl benzoates, nitrites, nitrates used as preservatives; Analysis of antioxidants in fats, such as BHT, BHA and gallates, coloring matter in soft drinks, alcoholic drinks, jam-jelly, sweets, contaminants-analysis of mercury, arsenic and trace elements.	**8**
3.	**Analysis of Drugs and Pharmaceuticals:** General pharmacology, qualitative aspects of drug action, receptors, role of absorption of drugs, routes for administration and elimination of drugs, gram positive and gram negative bacteria, 5-HT receptors and drugs action on 5-HT, non steroidal anti-inflammatory drugs. Analysis of chloramphenicol, chloroquine, phosphate, beta-methasone, amylobarbitone, analgin, ampicilline, ascorbic acid, aspirin and paracetamol.	**14**
4.	**Forensic Analysis of Common Poisons:** Poisoning due to arsenic, lead, cadmium, mercury and cyanide, general analytical approach; Case studies- death due to fire, explosions, drug overdose case; Alcohol- effects of alcohol, analysis of body fluid samples for alcohol, analysis of breath for alcohol. analysis of body fluids- biological evidence, blood analysis, DNA analysis.	**10**
	Total	**42**

Suggested Books:

S. No.	Authors/ Book/ Publisher	Year of Publication/Reprint
1.	Pearson D., "Lab Techniques in Food Analysis", Butter Worth and Co. Ltd.	**2003**
2.	Mayer L.H., "Food Chemistry", The AVI Publishing Co.	**2005**
3.	Mac Leod A.J., "Instrumental Methods of Food Analysis", Elec Science.	**1975**
4.	ISI Handbook of Food Analysis. Indian Standards Institution.	**2000**
5.	Rang H.P., Dale M.M. and Ritter J.M., "Pharmacology", Churchill Livingstone.	**1996**
6	George C, Thomas M and Pearmain H, "Aids to the Analysis of Foods and Drugs", 4th Ed., Bibliobazar, LLC, Bibliolife.	**2003**
7.	Pearmain T.H. and Moor C.G., "The Analysis of Foods and Drugs", Balliere, Tindall and Cox.	**2007**

1NAME OF DEPTT./CENTRE: **Department of Chemistry**

1. Subject Code: **CYN-762** Course Title: **Drug Design and Action**

2. Contact Hours: **L: 3** **T: 0** **P: 0**

3. Examination Duration (Hrs.): **Theory** 3 **Practical** 0

4. Relative Weightage**: CWS 25 PRS 0 MTE 25 ETE 50 PRE 0**

5. Credits**:** **3** 6. Semester**: Spring** 7. Subject Area**: PEC**

8. Pre-requisite**: Nil**

9. Objective: To provide knowledge of the design of drugs and their mode of action.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	**Drug Design Concepts**: Stereochemistry, formation of salts, solubility of drugs, importance of water solubility, structure activity relationships (SARs), quantitative structure activity relationships (QSARs), liphophilicity and stereo-electronic effects; Computer aided design and combinatorial methods, encoding methods, combinatorial synthesis in solution, screening and deconvolution.	**10**
2.	**Drugs and Their Action:** Sources of drugs, classification of drugs, routes of administration, pharmaceutical phase, pharmacokinetic phase, bioavailability of a drug and pharmacodynamic phase.	**4**
3.	**Examples of Drug Action:** Concept of antibiotics, membranes-types, transport across membranes, drugs that disrupt membranes, enzymes-biological catalysis enzyme kinetics, enzyme inhibition, design of enzyme inhibitors, reversible inhibitors, transition state inhibitors, irreversible inhibitors; Receptors and messengers – types, ligand responses, ligand-receptor interactions, binding affinity, designing receptor based drugs-agonists and antagonists; Drugs that target nucleic acids, nucleic acid synthesis, inhibitors.	**14**
4.	**Drug Metabolism**: Phase I and phase II metabolic reactions.	**2**
5.	**Drug Synthesis**: Importance of chiral drugs, asymmetry in synthesis –creation of stereospecific centers, methods of asymmetric synthesis and disconnection approach, enantiomeric separation and characterization methods, drugs based on steroid, non-steroid, substituted benzene ring, five and six membered heterocycles.	**12**
	Total	**42**

Suggested Books:

S. No.	Authors/ Book/ Publisher	Year of Publication/Reprint

1.	Thomas G., "Fundamentals of Medicinal Chemistry", John Wiley and Sons.	**2003**
2.	Lednicer D., "Strategies for Organic Drug Synthesis and Design", Wiley-Interscience, John Wiley and Sons.	**1988**
3.	Dugas H., "Bio Organic Chemistry, A.Chemical approach to enzyme action", 2nd Ed., Springer – Verlag.	**1989**
4.	Roth H. J. Kleemann A., "Pharmaceutical chemistry", Vol.1, Drug Synthesis.	**2001**
5.	Berger A., "Medicinal chemistry", Vol 1 and 2, Wiley Interscience.	**1990**

NAME OF DEPTT./CENTRE: **Department of Chemistry**

1. Subject Code: **CYN-751** Course Title: **Analysis of Industrial Polymers**

2. Contact Hours: **L: 3** **T: 0** **P: 0**

3. Examination Duration (Hrs.): **Theory** 3 **Practical** 0

4. Relative Weightage**: CWS 25 PRS 0 MTE 25 ETE 50 PRE 0**

5. Credits**:** **3** 6. Semester**: Spring** 7. Subject Area**: PEC**

8. Pre-requisite**: Nil**
9. Objective: To provide knowledge of polymer chemistry and analysis of industrial polymers.
10. Details of Course:

S. No.	Contents	Contact Hours
1.	**Introduction of Polymers:** Classification of polymers, homopolymers, copolymers, graft copolymers and their characteristic properties in reference to technological and industrial applications.	6
2.	**Thermal and Spectral Methods of Analysis of Polymers:** Applications of DSC, DTA, TG methods for analysis of homopolymers, copolymers, polymer blends and composites; Application of IR , NMR, X-ray diffraction neutron scattering, SEM and TEM techniques for analysis of polymers; Viscosimetry for the analysis of molecular mass and molecular dimension of polymer coils.	12
3.	**Mechanical Behavior of Polymers:** Analysis of mechanical properties such as tensile, polymers shear and flexural strengths.	6
4.	**Polymers for Advance Technologies:** Testing of polymers for electrical and electronic applications; Analysis of optical properties of polymers in presence of coloring agents, effects of radiation on stability of polymers.	6
5.	**Reinforced and Multi-component Polymers:** Analysis of fillers, antioxidants, stabilizers, plasticizers, fire retardants, pigments and other additives in industrial polymers using modern methods of analysis.	6
6.	**Commercial and Industrial Polymers:** Polymer liquid crystals, polymeric foams, polymer blends, thermosets and thermoplasts, biodegradable polymers, ion exchangers, engineering plastics and conducting polymers.	6
		42

Suggested Books:

S. No.	Authors/ Book/ Publisher	Year of Publication/Reprint

1.	Billmeyer Jr. F.W., "Text Book of Polymer Science", 3rd Ed., Wiley-Interscience.	**1994**
2.	Fried J.R., "Polymer Science and Technology", Prentice-Hall.	**2002**
3.	Seymeur R.B. and Carraher Jr. C.E., "Polymer Chemistry", Marcel Dekker.	**1981**
4.	Dyson R.N., "Specialty Polymer", Chapman and Hall.	**1987**
5.	Ku C.C., Liepins R., "Electrical Properties of Polymers", Hanser Publications.	**1987**
6.	Morgoles J M., "Conducting Polymers and Plastics", Chapman-Hall.	**1989**

NAME OF DEPTT./CENTRE: **Department of Chemistry**

1. Subject Code: **CYN-772** Course Title: **Nuclear Techniques for Analysis and Characterisation**

2. Contact Hours: **L: 3** **T: 0** **P: 0**

3. Examination Duration (Hrs.): **Theory** 3 **Practical** 0

4. Relative Weightage**: CWS 25 PRS: 0 MTE 25 ETE 50 PRE 0**

5. Credits**:** **3** 6. Semester**: Spring** 7. Subject Area**: PEC**

8. Pre-requisite**: Nil**

9. Objective: To impart in-depth knowledge on nuclear techniques for analysis and characterization of materials.

10. Details of Course:

Sl. No.	Particulars	Contact Hours
1	**Basic Radiochemistry:** Types of radioactivity, decay methods, radioactive equilibrium, choice and production of radio nuclides, interaction of radiation with matter.	**6**
2	**Nuclear Detector:** Properties of a detector, gas filled counters, scintillation and semiconductor detectors, clover detectors.	**4**
3	**Applications of Radioactivity:** Isotope dilution analysis, radioimmunoassay, radiochemical methods for determining biological activity, radiopharmaceutical, neutron activation analysis.	**8**
4	**Ion Beam Analysis and Micro-analysis:** Proton Induced X-ray Emission (PIXE), Rutherford Backscattering Spectrometry (RBS), nuclear reactions analysis. Nuclear Microprobe- μ-PIXE, μ-RBS, scanning transmission ion microscopy (STIM); Comparison with other microprobes- electron microprobe, synchrotron based μ-XRF	**10**
5	**Applications of Ion Beam Analysis:** Quantitative elemental imaging, applications to biomedical science, geological science, materials science, toxicology, single cell irradiation, proton beam writing for nanostructure fabrications.	**14**
	Total	**42**

Recommended Books:

S. No	Authors/Book/Publisher	Year of Publication/ Reprint

1	Ehmann W.D. and Vance D.E., “Radiochemistry and Nuclear Methods of Analysis”, John Wiley and Sons.	**1991**
2	Sood, D.D., Reddy A.V.R. and Ramamoorthy N., “Fundamentals of Radiochemistry” Indian Association of Nuclear Chemists and Allied Scientists.	**2004**
3	Johansson S.A.E., Campbell J.L. and Malmqvist K.G. (Eds), “Particle Induced X-Ray Emission Spectrometry, (Chemical Analysis: A series of monographs on Analytical Chemistry and Applications)”, Wiley Interscience.	**1995**
4	Meyer J.W. and Rimini, E., “Ion Beam Handbook for Material Analysis” Academic Press.	**1987**

NAME OF DEPTT/CENTRE: **DEPARTMENT OF CHEMISTRY**

1. Subject code: **CYN-782** Course Title: **Chemistry of Industrial Processes**
2. Contact Hours: **L: 3** **T: 0** **P: 0**
3. Examination Duration (Hrs): **Theory:** 3 **Practical:** 0
4. Relative Weightage: **CWS:** 25 **PRS:** 0 **MTE:** 25 **ETE** 50 **PRE:** 0
5. Credits: 3 6. Semester: **Spring** 7. Subject Area: **PEC**
8. Pre-requisite: Nil
9. Objective: To impart knowledge on different types of synthesis processes in industries and R&D
10. Details of the Course:

S. No.	Contents	Contact Hours
1.	**Chemicals and processes in petroleum industries.** Petroleum distillation, shale gas, naphtha versus gaseous feed stocks, heavier oil fractions, steam cracking and petroleum refining reactions, catalytic cracking, mechanisms of steam and catalytic cracking, catalytic reforming, oligomerization, alkylation, hydrotreating and coking, dehydrogenation, isomerization, metathesis, chemicals and polymers from ethylene, propylene, C4 stream, C5 stream, benzene, toluene, xylenes, synthesis gas and coal.	14
2.	**Catalysis and green chemistry**. Importance and role of catalysts, Catalyst choice, homogeneous and heterogeneous catalysis, catalysts promoters, catalysts poisoning, catalysis by acids and bases, dual function catalysis, catalysis by metals and metal oxides, semiconductors, and insulators, coordination catalysis, enzyme, shape-selective catalysts, phase-transfer and fluorous biphase catalysis, nanocatalysis, photocatalysts, green chemical methods, green solvents and green pharmaceuticals.	14
3.	**Industrial Processes:** oxidation, hydrogenations, isomerization reactions, synthetic route to menthol, carbonylations, water-gas shift reaction, hydroformylation, Fischer-Tropsch reaction, carbon-carbon bond forming reactions, alkylations, activation of aryl and vinyl halides, fine chemicals, metathesis of olefins, polymerization reactions, Ziegler-Natta catalysts, Phillips catalysts, metal-carbene, Schrock carbenes and Fischer carbenes.	14
	Total	**42**

11. Suggested Books:

S. No.	Name of Authors/Book/ Publisher etc.	Year of Publication/ Reprint
1	Chiusoli G.P. and Maitlis P.M. " Metal-catalysis in Industrial Organic Processes, Editor: RSC publishing,	2007
2	Dunn, P.J., Wells, A. and Williams, M.T. "Green Chemistry in the Pharmaceutical Industry", Wiley-VCH,	2010
3	Wittcoff, H.A., Reuben, B.G. and Plotkin, J.S. "Industrial Organic Chemicals" 3rd Edition, Wiley-VCH	2013