UG-13

K. S. Ranagasamy College of Arts and Science (Autonomous),

Tiruchengode – 637 215

Department of Chemistry

Elective Course

- Elective I: Spectroscopy I
- Elective I: Spectroscopy II
- Elective II: Green Chemistry and Nano Chemistry
- Elective II: Bio-Inorganic Chemistry

Encls:

1. Copy of Scheme of Examination
2. Syllabus copy of courses highlighting the Elective along with course outcomes
3. Mapping of courses to Elective

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HoD – Chemistry

CoE

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Subject Code	Subject	Hours of Instruction	Exam Duration (Hours)	Maximum Marks			Credit Points
				CA	CE	Total	
FIFTH SEMESTER							
PART III							
18UCHM501	Core VII: Inorganic Chemistry I	5	3	25	75	100	4
18UCHM502	Core VIII: Organic Chemistry I	5	3	25	75	100	5
18UCHM503	Core IX: Physical Chemistry I	4	3	25	75	100	4
18UCHM504	Core X: Analytical Chemistry	4	3	25	75	100	4
	Elective I	4	3	25	75	100	4
19UCHMP501	Core Practical IV: Gravimetric Estimation and Organic Preparation	5	6	25	75	100	3
PART IV							
18UCHSB501	SBC III: Polymer Chemistry	2	3	25	75	100	2
18UCHE501	Extension Activity	-	-	-	-	-	2
NON CREDIT							
18ULS501	Career Competency Skills III	1	-	-	-	-	-
	Total	**30**				**700**	**28**

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Subject Code	Subject	Hours of Instruction	Exam Duration (Hours)	Maximum Marks			Credit Points
				CA	CE	Total	
FIFTH SEMESTER							
PART III							
18UCHM601	Core XI: Inorganic Chemistry II	6	3	25	75	100	5
18UCHM602	Core XII: Organic Chemistry II	6	3	25	75	100	5
18UCHM503	Core XIII: Physical Chemistry II	6	3	25	75	100	4
-	Elective II	4	3	25	75	100	4
18UCHPR601	Project & Viva-Voce	5		25	75	100	4
PART IV							
18UCHSB501	SBC IV: Agricultural Chemistry	2	3	25	75	100	2
18ULS601	Career Competency Skills	1	-	-	-	-	-
	Total	**30**				600	24

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Elective I

The department offers the following three subjects as elective courses for Fifth semester

S.No	Semester	Paper code	Paper name
1.	V	18UCHEL501	Elective I: Spectroscopy I
2.	V	18UCHEL502	Elective I: Spectroscopy II

Elective II

The department offers the following three subjects as elective courses for Sixth semester

S.No	Semester	Paper code	Paper name
1.	VI	18UCHEL601	Elective II: Green Chemistry and Nano Chemistry
2.	VI	18UCHEL602	Elective II: Bio-Inorganic Chemistry

Advanced Learners' course:

The department offers the following two subjects as Advanced Learner's course for fifth semester

S.No	Semester	Subject Code	Subject
1.	V	18UCHAL501	Forensic Science
2.	V	18UCHAL502	Quantum and Solid State Chemistry

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18UCHEL501	ELECTIVE I: SPECTROSCOPY I	SEMESTER V

COURSE OBJECTIVES:

The course aims

- To dictate the rudimentary facts of the spectroscopic techniques
- To assess the principles and theories of IR spectroscopy
- To cater the cardinal rationale of NMR
- To compare IR with Raman spectroscopy
- To rationalize the concepts of Mass spectroscopy

Credits: 4 Total Hours: 40

Unit	Content	Hours	CO
I	**Introduction:** Electromagnetic radiation – units - Electromagnetic spectrum and absorption of radiations - Quantization of different forms of energies in molecules (translational, rotational and electronic) - Born Oppenheimer approximation. **Ultra violet and Visible spectroscopy:** Introduction – Beer-Lambert's law – Instrumentation – Types of electronic transition – Transition probability – Chromophore Auxochrome concept – Bathochromic, Hypsochromic, Hyperchromic, Hypochromic shift – Applications of UV spectroscopy.	8	CO1
II	**Infra-red spectroscopy:** Introduction – Principle - Theory of molecular vibrations - Expression for vibrational frequency (derivation not needed) - selection rules. Factors influencing vibrational frequencies – Instrumentation - Finger print region.	8	CO2
III	**Raman spectroscopy:** Introduction - Theory of Raman spectra (Stoke's and antistoke's line) – Instrumentation - Conditions for Raman spectroscopy - Beer lambert law of absorption in Raman scattering - Difference between IR and Raman spectra - Applications of Raman spectroscopy.	8	CO3
IV	**Nuclear Magnetic Resonance Spectroscopy:** Introduction – basic principles – Relaxation process – Chemical shift - Number and position of signals – Instrumentation – Shielding & Deshielding effects – Factors influencing chemical shift – Spin-Spin coupling – coupling constant – TMS as NMR standard – Applications of NMR	8	CO4

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V	**Mass spectroscopy:** Basic principles - Instrumentation - molecular ion peak, base peak, meta stable peak, isotopic peak their uses, determination of molecular formula. Fragmentation– Nitrogen rule - McLafferty rearrangements.	8	CO5

Text books:

1. *Sharma Y.R.* 2013. **Elementary Organic spectroscopy, [Fifth revised edition],** S. Chand & Co. Ltd., New Delhi.
2. *Sindhu P.S.* 1985. **Fundamentals of molecular spectroscopy**, New Age Int. Pvt. Ltd. New Delhi.

Reference books:

1. *Parikh V.M.* 2002. **Absorbtion spectroscopy of organic molecules,** Mehta publishers, Pune.
2. *Williams D.W.* and *Flemming I.* 1987. **Spectroscopic methods in organic chemistry**, McGraw-Hill, U.K.
3. *Kalsi P.S.* 2007. **Spectroscope of organic compounds**, New Age Int. Pvt. Ltd. New Delhi.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Reword the basics of spectroscopic techniques
CO2	Acknowledge the theory behind IR spectroscopy
CO3	Perceive the chemistry of NMR
CO4	Discern IR techniques with Raman spectroscopy
CO5	Agnize the concepts of Mass spectroscopy

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Mapping:

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	L
CO2	L	M	L	M	H
CO3	M	M	H	H	L
CO4	M	L	M	H	M
CO5	M	M	L	L	H

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18UCHEL502	ELECTIVE I: SPECTROSCOPY II	SEMESTER V

COURSE OBJECTIVES:

The course aims

- To illustrate the principles and concepts of ESR spectroscopy
- To paraphrase the concepts and applications of Mossbauer spectroscopy
- To prognosticate the chemicals compounds using AAS techniques
- To interpret the compounds using flame photometry techniques
- To recognize the utilization of fluorescence and phosphorescence techniques

Credits: 4 Total Hours: 40

Unit	Content	Hours	CO
I	**ESR Spectroscopy:** Introduction – Zeeman splitting – hyperfine splitting – g value – McConnel's equation – Krammer's degeneracy – spin orbital coupling – dipole-dipole interaction. Isotropic, rhombic and axial spectra of Copper II system	8	CO1
II	**Mossbauer Spectroscopy:** Introduction – Principle – basic concepts – Doppler shift – Resonance conditions - Recoil effect – Isomer shift – electric quadrupole splitting – magnetic dipole splitting – applications	8	CO2
III	**Atomic Absorption Spectroscopy:** Introduction – Principle – Grotrian Diagrams – Detection of non-metals by AAS – Difference between AAS & Flame emission spectroscopy – Instrumentation – Applications – Advantages and disadvantages.	8	CO3
IV	**Flame photometry:** Introduction – General principles – Instrumentation – Effect of Solvent – Factors affecting the intensity – Multielement analysis – Interferences- Applications – Limitations.	8	CO4
V	**Fluorimetry and Phosphorimetry:** Introduction – Comparison of Absorption and Fluorescence methods – Singlet and Triplet states – Excited state processes in molecules – Instrumentation – Application – Determination of Vitamins – Application of Phosphorimetry – Comparison of Fluorimetry and Phosphorimetry.	8	CO5

Text books:
1. *Gurdeep R. Chatwal, Sham K. Anand*, 2017, **Spectroscopy (Atomic and Molecular), Fifth Edition,** Himalaya Publishing House. 2. *Colin N. Banwell, Elaine M. McCash*, 2016, **Fundamentals of Molecular Spectroscopy [Fourth Edition],** McGraw Hill Education

Reference books:
1. *Parikh V.M.* 2002. **Absorbtion spectroscopy of organic molecules**, Mehta publishers, Pune. 2. *Williams D.W.* and *Flemming I.* 1987. **Spectroscopic methods in organic chemistry**, McGraw-Hill, U.K. 3. *Kalsi P.S.* 2007. **Spectroscope of organic compounds**, New Age Int. Pvt. Ltd. New Delhi.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Utilize the ESR techniques to interpret the spectrum of unknown compounds
CO2	Recall the working principles of Mossbauer spectroscopy
CO3	Detect the metals and non-metals using AAS technique
CO4	Analyse the multiple types of elements by flame photometry
CO5	Determine the compounds like vitamins by the concepts of Fluorimetry and phosphorimetry

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Mapping:

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	L	H	M	L
CO2	L	M	M	H	H
CO3	L	H	L	M	H
CO4	H	L	H	M	L
CO5	M	H	M	L	H

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18UCHEL601	ELECTIVE II : GREEN CHEMISTRY AND NANOCHEMISTRY	SEMESTER-VI

COURSE OBJECTIVES:

The course aims

- To instill the tools of green chemistry
- To impregnate the types of solvents and its properties
- To feed the basics of microwave assisted organic synthesis
- To inculcate the fundamentals of nano chemistry
- To enrich the analyzing and characterization techniques

Credits: 4 Total Hours: 40

UNIT	CONTENTS	HOURS	CO
I	**Green Chemistry:** Introduction - Need for green chemistry – principles of green chemistry – atom economy – Prevention or minimization of hazardous products, choice of solvents - green oxidant – hydrogen peroxide. **Tools of green chemistry:** Alternative starting materials, reagents, catalysts, solvents and processes with suitable examples.	8	CO1
II	**Green solvents:** Definition - Water as solvent - advantages of using water as solvent - physical properties of water - specific reactions in aqueous phase - Diels-Alder reaction – Hetero Diels-Alder reaction - Claisen rearrangement - Michael reaction - Pinacol coupling. **Super critical carbon dioxide (SCC):** Introduction - properties of super critical carbon dioxide - Use of SCC for extracting natural products - Use of SCC for dry cleaning.	8	CO2
III	**Microwave assisted organic synthesis** (MAOS): Apparatus required – examples of MAOS - Suzuki reaction - Heck reaction - Mannich reaction - Epoxide ring opening reaction - Diels-Alder cycloadditions - oxidation of Toluene - advantages and disadvantages of MAOS. **Organic reactions by sonication method:** Apparatus required – examples of sonochemical reactions (Heck,	8	CO3

	Hundsdiecker and Wittig reactions).		
IV	**Basics of Nanochemistry:** Introduction – definition – length scales – importance of nanoscale and its technology – self-assembly of materials – self-assembly of molecules – porous solids, nanowires, nanomachines and quantum dots. Nanoparticles – definition - Techniques to synthesize nanoparticles – top down and bottom up approaches – common growth methods - characterization of nanoparticles – applications of nanomaterials.	8	CO4
V	**Nanomaterials and their Characterization:** Preparation, properties and applications of carbon nanotubes, nanorods, nano fibre and nanoclay – toxic effects of nanomaterials. Characterisation techniques – scanning electron microscopy (SEM) – Transmission electron microscopy (TEM) – atomic force microscopy (AFM) – scanning tunneling electron microscope (STEM) (basic principles & block diagram).	8	CO5

Text Books:

1. *Sanghi R. S.* and *Srinivastava M. M.* 2003. **Green Chemistry: Environmental Friendly Alternatives**, Narosa Publishing House, New Delhi.
2. *Ahluwalia V. K.* and *Narosa.* 2011. **Green Chemistry**, New Delhi.
3. *Shanmugam S.* 2010. **Nanotechnology**, MJP Publishers, Chennai.

Reference Books:

1. *Salomon P. A* 2008. **Handbook on Nanochemistry**, Dominant Publishers and Distributers, New Delhi.
2. *Balaji S.* 2010. **Nanobiotechnology**, MJP Publishers, Chennai.
3. *Pradeep T.* 2007. **Nano: The Essentials**, Tata Mc-Graw Hill, New Delhi.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Quote the principles and processes of green chemistry
CO2	Restate the green solvents used in various organic reactions
CO3	Paraphrase the microwave assisted synthesis of organic compounds
CO4	Recite the fundamentals of Nano chemistry and types of nanomaterials
CO5	Evaluate the characterization techniques used for the analysis

Mapping:

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	L	H	M	L
CO2	L	M	M	H	H
CO3	L	H	L	M	H
CO4	H	L	H	M	L
CO5	M	H	M	L	H

H-High M-Medium L-Low

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18UCHEL602	ELECTIVE II : BIO-INORGANIC CHEMISTRY	SEMESTER-VI

COURSE OBJECTIVES:

The course aims

- To nurture the importance of metals in biological systems
- To render the role of metals and its complexes in the synthesis of drugs
- To impart the functions and properties of various metals
- To bestow the work of topical agents
- To forge the wreak of radioactivity in chemotherapy

Credits: 4 Total Hours: 40

UNIT	CONTENTS	HOURS	CO
I	**Metal ions in biological systems:** Essential and trace metals - alkaline and alkaline earth metals in biological systems, role of iron in living systems, biologically important complexes of Iron (transport proteins) - haemoglobin, myoglobin - Structure of haemoglobin and myoglobin. Bohrs effect – Nitrogen fixation, in vitro nitrogen fixation and in vivo nitrogen fixation.	8	CO1
II	**Co-ordination Compounds and Complexation**: Platinum complexes as anticancer drugs – cis-platin and trans-platin - Complexes of gold for Rheumatoid arthritis. Lithium complexes for mental health. Role of copper, zinc, mercury, arsenic and antimony in drugs. Biological functions and toxicity of chromium, manganese, cobalt, nickel and iodine.	8	CO2
III	**Role of Medicinal Inorganic Compounds:** Medicinal inorganic complexes - Alum, Phosphoric acid, Ferric ammonium citrate. Preparation, Properties and uses. Biological role of inorganic compounds - Sodium, Potassium, Calcium and Iodine. Na-K pump. Metal deficiency and diseases, Metal excess and toxicity.	8	CO3
IV	**Topical Agents:** Protectives - Calamine, Talc, Zinc Oxide, Zinc Stearate, Titanium dioxide. Astringents - Zinc sulphate, Alum. Anti-infectives: Boric acid, Hydrogen peroxide, Iodine. Dental Products: Anti-caries Agents - Role of Fluorides as anti-caries agents, Sodium fluoride.	8	CO4
V	**Inorganic Radio-Pharmaceuticals**: Radioactivity, Units of radioactivity, radiation dosimetry, Hazards and precautions in handling of radiopharmaceuticals and storage.	8	CO5

	Chemotherapy: Radio diagnostic agents - MRI scanning - Chelating Agents (with special reference to EDTA) and therapy based on in vivo chelation of radio nucleotides - Dosage and toxicity.		

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Recite the role of metal ions in biological systems
CO2	Quote the pharmaceutical behavior of metal complexes
CO3	Persuade the biological role of inorganic complexes
CO4	Hark the functions of various topical agents
CO5	Illustrate the chemistry of radio-pharmaceuticals

Mapping:

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	M	L	H
CO2	L	H	L	H	M
CO3	M	H	H	L	H
CO4	H	L	H	M	L
CO5	M	L	M	H	L

H-High M-Medium L-Low

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