केरल केन्द्रीय विश्वविद्यालय

Central University of Kerala

(Established by the Parliament of India under the Central Universities Act, 2009)

DEPARTMENT OF CHEMISTRY

School of physical sciences

Head of the Department

Tejaswini Hills
Periye, Kasaragod - 671320
Kerala, India

Minutes of the Board of Studies (BoS) meeting in Chemistry (through online) which was held on 08.07.2020.

Members Present:

- Prof. A. Sakthivel, Professor & Head, Department of Chemistry (BoS, Chairperson)
- Prof. T. P. Radhakrishnan, Professor, School of Chemistry, University of Hyderabad (Expert member)
- Prof. Balakrishna Kalluraya, Professor, Department of Chemistry, Mangalore University (Expert member)
- Dr. Gouri C., Scientist-G, VSSC Trivandrum (Expert member)
- Prof. T.Mohan Das, Professor & Head, Department of Chemistry, Central University of Tamil Nadu (Expert member)
- Prof. M. R. Prathapachandra Kurup, Dean, School of Physical Sciences (BoS, Member)
- Dr. Swapna Nair, HoD, Department of Physics (BoS, Member)
- Dr. Deepa Janardanan, Assistant Professor, Department of Chemistry (BoS, Member)
- Dr. Bini George, Assistant Professor, Department of Chemistry (Special invitee)
- Dr. Ravikumar Kanaparthi, Assistant Professor, Department of Chemistry (Special invitee)
- Dr. M. Bhagiyalakshmi, Assistant Professor, Department of Chemistry (Special invitee)

The BoS was conducted through online mode to discuss and finalize the following agenda:

Agenda 1: To consider the eligibility of non-mathematic students for our M.Sc. admission

Reason(s): Every year we have been receiving so many applications for M.Sc.(Chemistry) from various states of India. Several of the applicants had B.Sc.(Chemistry) with botany and zoology as ancillary subject. At present, we have kept mathematics in B.Sc. level is essential criteria and it should be one of the ancillary subject. Several times we were unable to admit some good students from other states and they are not able to get admission in our department. We request BoS to recommend the following amend as the minimum eligibility criteria for admission

1. B.Sc.(Chemistry) as major with allied subject as ancillary may consider for admission.

Recommendations:

After thorough discussion, BoS recommended that candidates with B.Sc. degree (with Chemistry as major and allied subjects as ancillary) may be considered for admission to the M.Sc. Chemistry program from the next academic year onwards.

The revised eligibility criteria based on the recommendation of BoS shall be as follows:

"B.Sc. Degree with a minimum of 55% marks or equivalent grade in aggregate and also for science subjects, with Chemistry as the main or one of the main subjects (studied in 10 + 2 +3 system). Up to 5 % relaxation in the minimum requirement of marks is granted to SC/ST candidates"

Agenda 2: Students may avail elective courses (listed below) and also MOOC course through SWAYAM portal (as recommended by the department faculty council).

Reason(s): Recently Department of Chemistry has introduced several elective courses and the details about the course title and course content are as follows

(a) Crystallography (CHE5014)

X-ray crystallography, solids, crystalline and amorphous solids, Crystal lattice, unit cell and asymmetric unit. Crystal systems and Bravais lattice. Weiss indices, Miller indices and Miller planes. X-ray diffraction by crystals, Bragg's law. Diffraction patterns and reciprocal lattice. Symmetry elements, inversion centre, reflection, rotation, rotation-inversion. Screw axis, Glide planes. Space groups, Herman-Maugein notation. Space groups, Space group diagrams. Special positions in space groups. Centrosymmetric and non-centrosymmetric space groups. Systematic absences in crystal data. Structure factors. Structure solution, phase problem, direct methods, Patterson methods. Refinement, least square method. Constraints and restraints. Hydrogen bonding and π-π interactions.

References

1. Li-ling Ooi, 2010, Principles of X-ray Crystallography, Oxford University press
2. Gregory S. Girolami, X-ray Crystallography, University Science books, California

(b) Pharmaceutical Chemistry (CHE 5015)

Bond type and bond strength, Hydrocarbons: alkanes, alkenes, aromatic and alkylhalides, Amines, Neutral and acidic nitrogen compounds, Oxygen- and sulphur-containing functional groups

Protein structure and its relevance to drug action, DNA structure and its importance to drug action, Drug absorption, distribution, metabolism and excretion.

Structure, activity and drug design, Drugs affecting the adrenergic system, Drugs exerting non-adrenergic effects on cardiac output and vascular tone, Drugs interacting with mammalian enzymes

Central nervous system depressants, Analgesics, Local anaesthetics, Anticholinergic agents, Antihistamine drugs, CNS stimulants and CNS-active drugs affecting the serotonergic system, Drugs affecting the endocrine system. Anticancer drugs, Antimicrobial chemotherapy, Antiviral drugs, Antifungal chemotherapy, Antiparasitic drugs, Vitamins and minerals, Biotechnologically produced products, Drug and gene delivery systems, The toxic and toxic effects of alcohol and its metabolites

References

Pharmaceutical Chemistry, Edited by David G Watson BSc PhD PGCE Reader in Pharmaceutical Sciences, Strathclyde Institute of Pharmacy and Biomedical Sciences, School of Pharmacy, University of Strathclyde, Glasgow, UK, Churchill Livingstone, Elsevier 2011.

(C) Molecular Fluorescence: Principles and Applications (CHE 5016)

Basics of Molecular Fluorescence:
Fundamental laws of photochemistry, nature of light and matter, Interaction of light with matter, Mechanism of absorption and emission, electronic transitions, selection rules, spectroscopic term symbols, physical properties of electronically excited molecules, Jablonski diagram, photophysical properties of the electronically excited molecules. Photophysical kinetics of bimolecular processes. Electron and energy transfer reactions.
Principles of steady-state and time-resolved fluorometric techniques:
Steady-state spectrofluorometry: Operating principles of a spectrofluorometer, Correction of excitation spectra, Correction of emission spectra, Measurement of fluorescence quantum yields, Problems in steady-state fluorescence measurements.
Time-resolved fluorometry: General principles of pulse and phase-modulation fluorometries, Single-photon timing technique and measuring fluorescence lifetimes.
Resonance energy transfer and its applications:
Determination of distances at a supramolecular level using RET, Single distance between donor and acceptor, Distributions of distances in donor-acceptor pairs and RET in ensembles of donors and acceptors etc. Effect of polarity on fluorescence emission and Polarity probes: What is polarity? Empirical scales of solvent polarity based on solvatochromic shifts, Single-parameter approach, Theory of solvatochromic shifts, Examples of PCT fluorescent probes for polarity and effects of specific interactions.
Fluorescent molecular sensors of ions and molecules:
Fundamental aspects, pH sensing by means of fluorescent indicators, Fluorescent molecular sensors of cations, Fluorescent molecular sensors of anions, Fluorescent molecular sensors of neutral molecules and surfactants

References

1. *Fundamental of Photochemistry* - KK Rohatgi Mukherjee, New Age Publishers, Third edition, ISBN-10: 8122434320.
2. *Molecular Fluorescence Principles and Applications* - Bernard Valeur, Wiley-VCH Verlag GmbH ISBNs: 3-527-29919-X (Hardcover); 3-527-60024-8 (Electronic).
3. *Principles of Fluorescence Spectroscopy* - Joseph R. Lakowicz, Springer Publishers, 3rd edition, ISBN 978-0-387-46312-4.

Currently all the above mentioned elective papers were thought in the second year of the M.Sc.. We request BoS to approve the following

(a) Elective courses to be introduce from the 2nd semester onwards. In addition, students will be encouraged to take elective courses from SWAYAM portal through MOOC (Massive Open Online course).

(b) Department faculty council has gone through the available MOOC courses and suggested the following courses. Students can take any one from the list so that their curriculum will have all sufficient contents.

Details about the department faculty council suggested MOOC courses are as follows

Sl. No.	Course Name	Course Coordinator	Institute	Duration of the Course (weeks)	Credits
1.	Environmental Chemistry	Prof. AK Bhakshi	Delhi University	15	4
2.	Forensic Chemistry and Explosives	Prof. AK Gupta	SHIATS, Allahabad	15	4
3.	Bioorganic & Biophysical Chemistry	Prof. AK Bhakshi	Delhi University	15	4
4.	Research Ethics	Mr. Manoj Kumar K.	INFLIBNET Centre, Gujarat	15	4
5.	Research Methodology	Prof. Bajpai	National Law University	15	4
6.	Academic Writing	Dr. Ajay Semalty	HNB Garhwal University	15	4
7.	Biomass Characterization	Prof. A. Arunkumar	Central University of Kerala	15	4
8.	Biophysical Chemistry	Prof. Pramit Kumar Chowdhury.	IIT-Delhi	12	3
9.	Laser: Fundamentals & Applications	Prof. Manbendra Chandra	IIT-Kanpur	8	2
10.	One and two dimensional NMR spectroscopy for chemistry	Prof. N. Suryaprakash	IISc Bangalore	12	3

We request the BoS to approve this agenda.

Recommendations:

(1) Instead of one elective course currently offered by the department in the 3rd semester, one more elective course may be offered so that there are two elective courses in the 3rd semester from the current semester onwards. Students can take two or more electives, as per the requirement in the following semester, i.e., 4th semester. Out of the two electives in the 3rd semester, students may be permitted to take at most one from among the MOOCs available.

(2) The proposed 10 MOOC courses are approved for the current 3rd semester, where **any one** of them from the available 10 listed courses can be chosen by the student.

(3) The students should take the consent of the Mentor & HOD before selecting the MOOC course from the list mentioned above.

Agenda 3: Minimum credit limit for MSc chemistry course - regarding

Reason(s): Currently we have fixed total number of credits for M.Sc. as 72 (60 core + 12 elective) as the minimum number of credits required for the award of M.Sc. (Chemistry), of which each semester, the maximum credit limit is fixed as 30. The credit limit for each semester may be re-fixed as 20 core and the rest can be acquired from elective course(s). The BoS may recommend the same.

Recommendations:

Committee recommends the following

Students can acquire a maximum of 20 credits from the core courses per semester; the maximum credits that can be earned from core and elective courses per semester will be 30.

Additional Suggestions from BoS:

(1) A basic course "*Mathematics for Chemists*" (core or foundation) may be introduced to provide adequate mathematics background for all M.Sc. Chemistry students for an effective understanding of the various branches of chemistry; this would require formal approval from the BoS.

(2) A sufficient proportion of basic mathematics questions may be introduced in the admission test i.e., CUCET to ensure that the students being admitted possess essential basic knowledge of mathematics (which can be augmented with the mathematics for

ELECTIVE COURSES

(To be taken during the IIIrd & IVth Semester)

CHE 5001 Instrumental Methods of Analysis

Elementary electronics - semiconductors - properties - semiconductor diodes- transistors- mechanism of amplification- field effect transistors – transformers- rectifiers- voltage regulators – noise – signal - to – noise ratio - readout devices - cathode ray tube

Electrogravimetry - coulometry - constant current and constant potential coulometry- applications-primary and secondary coulometry – conductance measurement – conductometric titrations. Ion-selective electrodes, ion-selective FET, immobilized enzyme electrodes construction.

Polarography – current – voltage curve. DME-components of polarographic current – supporting electrolyte – polarographic maxima. Half-wave potential-Instrumentation-Applications of Polarography. Pulse and differential pulse polarography-chronopotentiometry - stripping analysis. Amperometric titrations – Different types. Applications. Cyclic voltrametry - Theory and applications.

UV-VIS and IR Spectrophotometry. Basic instrumentation for UV-Vis and IR spectrophotometry - single beam and double beam instruments, FT-IR, Fundamental laws of photometry - deviations from Beers law - photometric accuracy –relative photometric error– simultaneous determination of two components-. Nephelometry and turbidimetry.

Instrumentations of FT-NMR, advanced Mass Spectrometry including hyphenated techniques, introduction to X-ray diffraction.

Flame Emission and Atomic Absorption Spectrometer. Instrumentation of AAS, the flame spectra, flame characteristics. Atomizers used in spectroscopy, Hollow cathode lamp interference in AAS-applications. Atomic emission spectroscopy-flame photometry-simultaneous multi element analysis.

Chromatography-classification - column-paper and thin layer chromatography. HPLC -outline study of instrument modules. Ion – exchange chromatography - Theory. Important applications of chromatographic techniques. Gel Permeation Chromatography.

Gas chromatography–basic instrumental set up-carriers, columns, detectors and comparative study of TCD, FID, ECD and NPD. Qualitative and quantitative studies using GC, Preparation

of GC columns, selection of stationary phases of GLC, Gas adsorption chromatography, applications, CHN analysis by GC.

Thermal methods of Analysis TG, DTA and DSC - Instrumentation and Theory – effect of atmosphere on TG and DTA. TG of copper sulphate pentahydrate and calcium oxalate monohydrate. Application of thermal methods for identification of substances.

Automated methods of analysis-advantages and disadvantages-types of automatic analytical systems- flow injection analysis- instrumentations – applications-discrete automatic systems.

References

1. D.A. Skoog and D.M West, Principles of Instrumental Analysis, 2nd Edn., Saunders college, Philadelphia, 1980.
2. Pecksock, Shields, Carrns and Mc William, Modern Methods of Chemical Analysis, John Wiley, 2nd Edn., 1976.
3. H.H. Willard , L.L. Merrit, J.A. Dean and F.A. Settle, Instrumental Methods of Analysis, D, Van Nonstrand, N.Y, 1981.
4. F.W. Fifield and D. Kealey, Principles and Practice of Analytical Chemistry, 2nd Edn., International Book Company, London, 1983.
5. Leitinon and W. Harris, Chemical Analysis, 2nd Edn., McGraw Hills, Tokyo, 1975.
6. H.A. Donald and F. Calbreath, Clinical chemistry- A fundamental text book, An HBJ international Edn., W.B. Saunders, 1992.
7. K. Wilson and J. Walker, Practical Biochemistry-Principles and Techniques, Cambridge University Press, 1995.

Course Outcome:

- Understanding of the fundamental principles of instrumental measurements.
- Application of these principles to specific types of chemical measurements (type of sample analysed, figures of merit, strengths and limitations).
- Use of instruments to solve real analytical problems.