KANNUR UNIVERSITY

(Abstract)

B.Sc Polymer Chemistry-Scheme & syllabus of Core Courses (I&II Semesters only) under Choice Based Credit Semester System for Under Graduate Programme-implemented with effect from 2009 admission-Orders Issued.

ACADEMIC BRANCH

No.Acad/C2/754/2007 (2) Dated, K.U.Campus. P.O,10- 07-2009.

Read: 1.Minutes of the meeting of the Board of Studies in Chemistry (UG) held on 25-05-2009.

2. Minutes of the meeting of the Faculty of Science held on 16-06-2009.
3. U.O No.Acad/C2/3838/2008 (i) dated 07-07-2009
4. Letter dated 03-07-2009 from the Chairman, BOS in Chemistry (UG).

ORDER

1.The Board of Studies in Chemistry (UG) vide paper read(1) above has prepared, finalized and recommended the Scheme and Syllabus of Core Courses for B.Sc Polymer Chemistry Programme under Choice Based Credit Semester System for implementation from 2009 admission.

2. The recommendations of the Board in restructuring the syllabus is considered by the Faculty of Science vide paper read (2) and recommended for the approval of the Academic Council.

3. The Regulations for Choice based Credit Semester System is implemented in this University vide paper read (3).

4. The Chairman, BOS in Chemistry (UG), vide paper (4) above forwarded the restructured Scheme and Syllabus of Core Courses (I &II Semesters only) for B.Sc Polymer Chemistry Programme under Choice Based Credit Semester System, prepared by the Board of Studies in Chemistry (UG) for implementation with effect from 2009 admission.

5. The Vice Chancellor, after examining the matter in detail, and in exercise of the powers of the Academic Council as per section 11(1) of Kannur University Act 1996 and all other enabling provisions read together with, has accorded sanction to implement the scheme and syllabus of Core Courses (I &II Semesters only) for B.Sc Polymer Chemistry Programme restructured in line with Choice Based Credit Semester System,with effect from 2009 admission, subject to ratification by the Academic Council.

6. The restructured scheme and syllabus of Core Courses(I &II Semesters only) for B.Sc Polymer Chemistry Programme under Choice Based Credit Semester System, implemented with effect from 2009 admission is appended.

7. The Scheme and Syllabus of Complementary Courses offered for this Programme will be available along with the syllabus of Core Courses of the Complementary subject.

8. The affiliated Colleges are not permitted to offer Complementary Courses in violation to the provisional/permanent affiliation granted by the University. Changes in Complementary Courses are permitted with prior sanction /revision in the affiliation order already issued in this regard.

9. If there is any inconsistency between the Regulations for CCSS and its application to the Scheme & Syllabus prepared, the former shall prevail.

10.. Orders are issued accordingly.

Sd/-
REGISTRAR

To:

1. The Principals of Colleges offering B.Sc Polymer Chemistry Programme
2. The Examination Branch (through PA to CE)

Copy To:

1. The Chairman, BOS Chemistry (UG)
2. PS to VC/PA to PVC/PA to Regr
3. DR/AR I Academic
4. Central Library
5. SF/DF/FC.

Forwarded/By Order

SECTION OFFICER

K A N NU R U N I V E R S I T Y

COURSE STRUCTURE

&

SYLLABUS

FOR

UNDERGRADUATE PROGRAMME

IN

POLYMER CHEMISTRY

CORE COURSES

UNDER

CHOICE BASED CREDIT SEMESTER SYSTEM

w.e.f 2009 ADMISSION

COURSE STRUCTURE FOR UG PROGRAMME
POLYMER CHEMISTRY

SEMESTER 1

No	Title of the Course	Hours /week	Credits
1	Common Course I (English)	5	4

2	Common Course II (English)	4	3
3	Common Course I (Additional Language)	5	4
4	Core Course 1	3	3
5	Complementary 1 (Course I)	4	2
7	Complementary 2 (Course I)	4	3

SEMESTER 2

No	Title of the Course	Hours/week	Credits
1	Common Course III (English)	5	4
2	Common Course IV (English)	4	3
3	Common Course II (Additional Language)	5	4
4	Core Course 2	3	3
6	Complementary 1 (Course II)	4	2
8	Complementary 2 (Course II)	4	3

SEMESTER 3

No	Title of the Course	Hours/week	Credits
1	Common Course (General)	3	3
2	Common Course (General)	5	3
3	Core Course 4	3	3
4	Core Course 3, Practical Part I	2	-
5	Core Course 5 Practical II,Part I	2	-
6	Complementary 1 (Course III)	5	2
7	Complementary 2 (Course III)	5	3

SEMESTER 4

No	Title of the Course	Hours/week	Credits
1	Common Course (General)	5	7
2	Common Course (General)	3	3
3	Core Course 6	3	3
4	Core Course 5, Practical Part II	2	2
5	Core Course 3 Practical II, Part I	2	2
6	Complementary 1 (Course IV)	5	2
7	Complementary 2 (Course IV)	5	3

SEMESTER 5

No	Title of the Course	Hours / week	Credit
1	Open Course 1	2	2
2	Core Course 7	5	4
3	Core Course 8	4	4
4	Core Course 9	4	4

5	Core Course 10	5	-
6	Core Course 11	5	-

SEMESTER 6

No	Title of the Course	Hours / week	Credit
1	Open Course 2	2	2
2	Core Course 13	5	4
3	Core Course 14	4	4
4	Core Course 15(Elective)	4	4
5	Core Course 16	5	4
6	Core Course 10& 11 Practical III& IV	5	6
7.	Core Course 12 Project/Industrial Visit	*	4

The distribution of Hour/Credit for Theory/Practical shall be decided by the Board of Studies concerned.

Scheme Common Courses-General (Polymer Chemistry)

No	Semester	Course Code	Title of the Course	Hours / week	Credit
1	III	3A05PCH	Common course- Polymer Chemistry I 1	3	3
2	III	3A06PCH 3A06(A)PCH	Common course -Polymer Chemistry II Common course- Polymer Chemistry II (Practical)	3 2	3 *
3	IV	4A09PCH 4A06(A)PCH	Common course- Polymer Chemistry III Common course - Polymer Chemistry II (Practical)	3 2	3 4
4	IV	4A10PCH	Common course- Polymer Chemistry IV	3	3

Scheme Polymer Chemistry (Core)

No	Semester	Course Code	Title of the Course	Contact Hr/week	Credits

1	I	1B01PCH	Methodology of Polymer chemistry as discipline of science	3	3
2	II	2B02PCH	Theoretical and Inorganic chemistry	3	3
3	III	3B04 CHE	Inorganic chemistry-I	3	3
4	III	3B03PCH	Core course practical Volumetric analysis Part I	2	-
5	III	3B05CHE	Core course practical -I I Inorganic qualitative analysis & preparation part - I	2	-
6	IV	4B06 CHE	Inorganic chemistry-II	3	3
7	IV	4B05 CHE	Core course practical -I I Inorganic qualitative analysis & preparation part – II	2	2
8	IV	4B03PCH	Core course practical Volumetric analysis Part II	2	2
9	V	5B07 CHE	Physical chemistry –I	5	4
10	V	5B08 CHE	Physical methods in chemistry	4	4
11	V	5B09 CHE	Organic chemistry-I	4	4
12	V	5B10 CHE	Core course practical-III Gravimetric analysis	5	-
13	V	5B11 CHE	Core course practical-IV Organic chemistry	5	-
14	V&VI	5B12 CHE	Project /Industrial visit	-	4
15	VI	6B13 CHE	Physical chemistry –II	5	4
16	VI	6B14 CHE	Organic chemistry-II	4	4
17	VI	6B15 CHE	Elective	4	4
18	VI	6B10&11CHE	Core course practicals –III&IV	5	6
19	VI	6B16 CHE	Core course practical Physical chemistry	5	4

Scheme Elective

No	Semester	Course Code	Title of the Course	Contact Hr/week	Credits
1	6	6B15CHE	A. Environmental chemistry	4	4
2	6	6B15CHE	B. Food chemistry	4	4
3	6	6B15CHE	C. Industrial chemistry	4	4
4	6	6B15CHE	D. Synthetic organic chemistry	4	4

5	6	6B15CHE	E. Analytical chemistry	4	4
6	6	6B15CHE	F. Nano materials –synthesis & practice	4	4

Scheme Open Courses

No	Semester	Course Code	Title of the Course	Contact Hr/week	Credits
1	5	5D01CHE	Chemistry in service to Man	2	2
2	5	5D02CHE	Chemistry in everyday life	2	2
3	5	5D03CHE	Environmental Studies	2	2
4	6	6D04CHE	Drugs-Use & Abuse	2	2
5	6	6D05CHE	Food Science	2	2
6	6	6D06CHE	Nano Materials Synthesis & Practice	2	2

The syllabus of Common Courses (General) for III and IV Semesters shall be framed and communicated later. The rest of the Courses offered as Core Courses (Theory) will be the same as that of B.Sc Chemistry Programme.

1B01PCH – Methodology of Polymer Chemistry as a Discipline of Science

Credits-3 **(54 hrs)**

Aim: To illustrate the methodology of science in chemistry

Objectives :

- To have a broad outline of the methodology of science in general and Chemistry in particular.
- To understand the important analytical and instrumental tools used for practicing chemistry.

- To learn computer based presentation and statistical analysis of data using spreadsheet software.
- To apply these skills in the analysis of experimental data in chemistry practical.

Module - 1 Chemistry as a discipline of Science

(9 hrs)

What is Science? Scientific statements, Scientific methods – observation – posing a question – formulation of hypothesis – experiment theory – law. Falsification (disproving) of hypothesis, inductive and deductive reasoning, revision of scientific theories and laws.

Methods of Science as illustrated through the following:

i) Laws of chemical combination – Faradays laws of electrolysis – Daltons atomic theory – atom models – J.J.Thomson, Rutherford, Bohr model and quantum mechanical model of atom.

ii) n-P-V-T relation of gases-gas laws – kinetic molecular theory.

Role of concepts and models in Science.

Evolution of Chemistry – ancient speculations on the nature of matter, early form of chemistry – alchemy, origin of modern chemistry. Structure of chemical science: scope of chemical science, theory and experiment, branches of chemistry. Role of Chemistry as a central science connecting Physics, Biology and other branches of science. Interdisciplinary areas involving Chemistry – Nanotechnology, Biotechnology.

Chemical science in the service of man: Drugs, food, flavouring agents, sweeteners, cosmetics, soaps and detergents, paints, varnishes, textiles, dyes, fertilizers, insecticides, fuels etc. – examples in each.

Methodology of chemistry: Symbols, formulae, Chemical equations, classification (periodic classification of elements, classification of organic compounds into homologous series), Analysis (qualitative and quantitative), preparation, synthesis, manufacture.

References

1. J.A.Lee, Scientific Endeavor, Addison Wesley Longman (chapters 1 and 2)
2. C.N.R. Rao, University Chemistry, Universities Press (India) Pvt. Ltd (Chapters 1 and 2)

Module –2. Research in Science (9 hours)

Selecting a topic – hypothesis – design of experiment: variables, correlation and causality, sampling, use of controls, experimental bias, analysis, results, discussion of results, models. Summary of the scientific methods. Writing Science.

Reference

J.A.Lee, Scientific Endeavor, Addison Wesley Longman (chapters 3, 9 and Appendix 3)

Module-3. Analytical and synthetic methodologies in Chemistry (9 hours)

Titrimetric analysis : Fundamental concepts – mole, molarity, molality, ppm and ppb primary standard – secondary standard, quantitative dilution – problems. Acid base titrations – titration curves – pH indicators. Redox titrations – titration curve – titrations involving MnO_4^- and $Cr_2O_7^{2-}$ - redox indicators. Complexometric titrations – EDTA titrations – titration curves – indicators – **Gravimetric analysis**: Unit operations in gravimetric analysis illustrations using iron and barium estimation. **Synthetic methodologies** – condensation – addition – examples. Separation and purification techniques – Filtration, Crystallization and precipitation – concept of solubility product as applied in group separation of cations – problems. Fractional distillation, Solvent extraction.

References

1. B.R.Puri, L.R. Sharma, Kalia, Principles of Inorganic Chemistry, Milestone Publishers, New Delhi (Chapter 40).
2. D.A.Skoog, D.M.West and S.R. Crouch, Fundamentals of Analytical Chemistry 8th edn, Brooks/Cole Nelson Chapters 12-17).
3. Vogel's Text book of Quantitative Chemical Analysis 6th edn, Pearsons Education Ltd (Chapters 10, 11).
4. G.D.Christian, Analytical Chemistry, John Wiley and Sons (Chapters 5, 7, 8, 16, 17)

Module-4. Data Analysis (9 hours)

Units, significant digits, rounding, scientific and prefix notation, graphing of data – Precision and accuracy – Types of errors – Ways of expressing precision – Ways to reduce systematic errors – reporting analytical data, Statistical treatment of analytical data – population and samples – Mean and standard deviation – distribution of random errors – confidence limits – tests of significance – Correlation and regression – linear

regression analysis, calculation of regression coefficients (slope, Intercept) using scientific calculator – methods of least squares.

The following section is non-evaluative for theory examination

Familiarization of software packages for analysis and graphical representation of data – MS Excel, Origin, Open office calc (Physical Chemistry experiments using software packages are included in the 5^{th} and 6^{th} semesters), simulations, virtual experiments, drawing molecular structures using Chemsketch, ISIS Draw.

References

1. B.R. Puri, L.R. Sharma, Kalia, Principles of Inorganic Chemistry, Milestone Publishers, New Delhi (Chapter 40)
2. J.A.Lee, Scientific Endeavor, Addison Wesley Longman (Appendices 1, 2 and 4)
3. D.A.Skoog, D.M.West and S.R.Crouch, Fundamentals of Analytical Chemistry 8^{th} edn, Brooks/Cole Nelson (Chapters 5-8)
4. Vogel's Text book of Quantitative Chemical Analysis 6^{th} edn, Pearsons Education Ltd (Chapters 4).
5. G.D.Christian, Analytical Chemistry, John Wiley and Sons (Chapters 2)
6. R.Crouch and F.J.Holler, Applications of Microsoft Excel in Analytical S.Chemistry, Brooks/Cole.

Further Reading

1. J.Mills and P.Evans, Core Chemistry, Foundation books Pvt. Ltd, New Delhi (2004)
2. T.F.Gieryn,Cultural boundaries of science, University Chicago Press, 1999.
3. H.Collins and T.Pinch, The Golem, What everyone should know about science, Cambridge University Press, 1993.
4. Hewitt, Paul G, S.Lyons, J.A.Suchocki and J.Yeh, Conceptual Integrated Science, Addison Wesley, 2007.
5. Methods for Teaching Science as Inquiry, Allyn and Bacon, 2009.
6. K.V.S. Sarma, Statistics made simple, Prentice – Hall of India, New Delhi.
7. R.Crouch and F.J.Holler, Applications of Microsoft Excel in Analytical S.Chemistry, Brooks/Cole.
8. R.D.Jarrard, Scientific Methods, jarrad@mines.utah.edu,2001.
9. R.Sangenburg D.K.Moser, History of Science (5 Volumes), Universities Press (India) Ltd.

Module – 5 : Redox Reactions (18 Hours)

Classical concept of Oxidation and Reduction. Electronic concept of oxidation number. Rules for assigning oxidation number. Calculation of oxidation number. Balancing redox reaction – oxidation number method and iron electron method.

References

1. Inorganic chemistry by Puri & Sharma
2. Advanced inorganic chemistry by F.A. Cotton & Wilkinson.

2B02PCH : Theoretical and Inorganic Chemistry

Credits-3 **(54 Hrs**)

Aim

To impart essential theoretical knowledge on atomic structure, periodic properties, chemical bonding, and nuclear chemistry.

Objectives:

- To study the various atom models.
- To understand the important features of the quantum mechanical model of the atom.
- To study the periodic properties of elements.
- To explain the formation of different types of bonds.
- To predict the geometry of simple molecules.
- To explain the different types of hybridisation and draw shapes of simple covalent molecules.
- To understand the molecular orbital theory of diatomic molecules.
- To develop interest in various branches of inorganic chemistry.
- To study nuclear models and nuclear reactions.

<u>Module – 1</u>. Atomic Structure **(10 Hrs)**

Bohr model of hydrogen atom, Bohr's equation for the energy of electron in hydrogen atom, the hydrogen spectrum, limitations of Bohr theory, photoelectric effect, idea of de Broglie matter waves, Heisenberg's uncertainty principle and its significance, Schrodinger wave equation (derivation not expected), wave functions, significance of Ψ (psi) and Ψ^2, atomic orbitals, Nodal planes in atomic orbitals, quantum numbers (n, l, m), Zeeman effect, Stern-Gerlac experiment, spin quantum number(s), shapes of s, p and d

orbitals. Aufbau and Pauli's exclusion principles, Hund's rule, energy level diagram of a multielectron atom, concept of effective nuclear charge, Slater's rules and applications, Electronic configuration of atoms.

References

1. J.D.Lee, Concise Inorganic Chemistry, 5th edn, Blackwell Science, London (Chapter 1)
2. B.R.Puri, L.R.Sharma, Kalia, Principles of Inorganic Chemistry, Milestone Publishers, New Delhi (Chapter 1).
3. C.N.R.Rao, University General Chemistry, Macmillan, 3rd edn., John Wiley 2001 (Chapter 1).
4. F.A.Cotton, G.Wilkinson and P.L.Gans, Basic Inorganic Chemistry, 3rd edn., John Wiley (Chapter 2).
5. D.F.Shriver and P.W.Atkins, Inorganic Chemistry, 3rd edn., Oxford University Press (Chapter 1).
6. B.Douglas, D.Me Daniel, John Alexander, Concepts and models in Inorganic Chemistry (Chapter 1).

<u>Module – 2</u>. Chemical Bonding (16 hrs)

Ionic bond – nature of ionic bond, properties of ionic compounds, radius ratio and coordination number, factors favouring the formation of ionic compounds. Lattice energy, Born-Lande equation with derivation, factors affecting lattice enthalpy, Born-Haber cycle and its applications, solvation enthalpy and solubility of ionic compounds.

Covalent bond – valence bond theory and its limitations, concept of resonance, resonance energy, hybridisation and shapes of simple molecules (BeF_2, PCI_3, SF_6, CH_4, Ethane, ethene and ethyne) VSEPR theory, shapes of molecules and ions (NH_3, XeF_6, CIF_3, NH_4^+, H_3O^+). Molecular orbital theory – LCAO method, molecular orbital energy diagram and properties of homo and hetero diatomic molecules (N_2, O_2, CO and NO), bond strength and bond energy. Polarisation of covalent bond, polarising power and polarisability of ions, Fajan's rule.

Dipole moment and molecular structure – percentage ionic character from dipole moment.

Metallic bonding – free electron theory, valence bond theory and band theory, explanation of metallic properties based on these theories.

Weak chemical forces – hydrogen bond, inter and intra molecular hydrogen bonds, effects of hydrogen bonding, van der Waals forces.

References

1. J.D.Lee, Concise Inorganic Chemistry, 5th edn., Blackwell Science, London (Chapter 2-5).

2. B.R.Puri, L.R.Sharma, Kalia, Principles of Inorganic Chemistry, Milestone Publishers, New Delhi (Chapter 4, 5).
3. C.N.R.Rao, University General Chemistry, Macmillan 3rd edn., John Wiley, 2001 (Chapter 3)
4. F.A.Cotton, G.Wilkinson and P.L.Gans, Basic Inorganic Chemistry, 3rd edn., John Wiley (Chapter 3, 4).
5. D.F.Shriver and P.W.Atkins, Inorganic Chemistry, 3rd edn., Oxford University Press (Chapter 2, 3).

Module 3 :Nuclear Chemistry (10 Hrs)

Nuclear particles, nuclear forces, nuclear size, nuclear density, stability of nucleus, binding energy, magic numbers, packing fraction, n/p ratio. Nuclear models – liquid drop model and shell model.

Natural radioactivity, modes of decay, decay constant, half life period, average life, radioactive equilibrium, Geiger-Nuttal rule, units of radioactivity, radiation dosage.

Induced radioactivity, nuclear reactions induced by charged projectiles, neutrons and γ rays fission reactions, fusion reactions, spallation reactions, preparation of transuranic elements, Q values of nuclear reactions. Fertile and fissile isotopes, chain reaction, stellar energy.

References

1. B.R.Puri, L.R.Sharma, Kalia Principles of Inorganic Chemsitry, Milestone Publishers, New Delhi (Chapter 38).
2. H.J.Arnikar, Essentials of Nuclear Chemistry, New Age International (Chapter 3 –5).
3. R.Gopalan, Elements of Nuclear Chemistry, Vikas, Publ. House.

Further Reading

1. J.E.Huheey, E.A.Keiter, R.L.Keiter, Inorganic Chemistry, 4th edn., Harper Collins, 1993.
2. G.Wulfsberg, Inorganic Chemistry, Viva Books.
3. W.L.Jolly, Inorganic Chemistry, Ttata Mc Graw Hill.
4. J.D.Lee, New Concise Inorganic Chemistry.
5. M.N.Greenwood and A.Earnshaw, Chemistry of the elements 2nd edn., Butterworth.
6. Manas Chanda, Atomic structure and chemical bonding.

7. H.J.Emeleus, A.G.Sharpe, Modern Aspects of Inorganic Chemistry, Universal Book Stall.
8. J.David Brown, the Chemical Bond in Inorganic Chemistry, Oxford Science Publication.

Module 4: Non aqueous solvents (18 Hours)

Classification of solvents- solubility of various substances. Liquid ammonia-solubility of ironic compounds-solubility of organic compounds-solubility of alkali and alkaline earth metals and its characteristics-solvolysis-reactions in liquid ammonia, liquid sulphurdiaoxide-solubility of substances in liquid sulphurdiaxide. Acid-base and solvolytic reaction-liquid hydrogen fluoride. Behaviour of different substances in liquid hydrogen fluoride. Chemical reactions in liquid hydrogen fluoride.

References

3. Inorganic chemistry by Puri & Sharma
4. Advanced inorganic chemistry by F.A. Cotton & Wilkinson.

Sd/-
Dr.K.Pradeep Kumar,
Chairman, BOS Chemistry (UG).