

KANNUR UNIVERSITY

(Abstract)

B.Sc Polymer Chemistry Programme-Revised scheme & syllabus of General Courses (III & IV Semesters) effective from 2009 admission under Choice based Credit Semester System-Implemented-Orders Issued.

ACADEMIC BRANCH

No.Acad/C2/754/2007 (1)

Dated, K.U.Campus. P.O, 08-06-2010.

Read: 1.U.O.No Acad/C2/754/2007(2) dated 10-07-2009.

2. Minutes of the meeting of the Board of Studies in Chemistry(UG) heldon 30-10-2009.

3. Letter dated 21-05-2010 from the Chairman, BOS in Chemistry (UG).

ORDER

1.The Scheme(full) and Syllabus (I and II Semesters only) of B.Sc Polymer Chemistry Programme under Choice based Credit Semester System were implemented in this University with effect from 2009 admission, as per paper read(1) above.

2.The Board of Studies in Chemistry (UG) vide paper read(2) above has recommended to revise the scheme and finalise the syllabus of the General Courses of B.Sc Polymer Chemistry Programme for implementation with effect from 2009 admission.

3. The Chairman, BOS in Chemistry (UG), vide paper read (3) above has forwarded the revised scheme and finalised Syllabus of General Courses (III &IV Semesters) for B.Sc Polymer Chemistry Programme under Choice based Credit Semester System, for implementation with effect from 2009 admission.

4.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 revised scheme and syllabus of General Courses (III &IV Semesters) for B.Sc Polymer Chemistry Programme in line with Choice based Credit Semester System, with effect from 2009 admission*, subject to report to the Academic Council.

5. The syllabus of General Courses (III &IV Semesters) for B.Sc Polymer Chemistry Programme under Choice based Credit Semester System, implemented with effect from 2009 admission are appended.

6. The rest of the Courses for Polymer Chemistry Programme will be the same as that of B.Sc Chemistry Programme, effective from 2009 admission.

7.Orders are issued accordingly. 8.The U.O read above stands modified to this extent.

Sd/-

To:

REGISTRAR

The Principals of Colleges offering B.Sc Polymer Chemistry Programme

Copy To:

1.The Examination Branch (through PA to CE)

Forwarded/By Order

2.The Chairman, BOS Chemistry (UG)

3. PS to VC/PA to PVC/PA to Regr

SECTION OFFICER

4.The Computer Programmer(to publish in the website)

5. DR/AR I Academic 6. SF/DF/FC.



KANNUR UNIVERSITY

SCHEME

&

SYLLABUS (III to VI Semesters)

FOR

UNDERGRADUATE PROGRAMME

IN

POLYMER CHEMISTRY

CORE/GENERAL COURSES

UNDER

CHOICE BASED CREDIT SEMESTER SYSTEM

w.e.f 2009 ADMISSION

Scheme-Core Course Chemistry (applicable for Polymer Chemistry also)

No	Semester	Course Code	Title of the Course	Contact Hours/week	Credits
1	III	3B04 CHE	Inorganic Chemistry-I	3	3
2	III	3B03CHE	Core Course Practical Volumetric Analysis Part I	2	-
3	III	3B05CHE	Core Course Practical -I I Inorganic Qualitative Analysis & Preparation Part -I	2	-
4	IV	4B06 CHE	Inorganic Chemistry-II	3	3
5	IV	4B05 CHE	Core Course Practical -I I Inorganic Qualitative Analysis & Preparation Part -II	2	2
6	IV	4B03CHE	Core Course Practical Volumetric Analysis Part I	2	2
7	V	5B07 CHE	Physical Chemistry –I	5	4
8	V	5B08 CHE	Physical Methods in Chemistry	4	4
9	V	5B09 CHE	Organic Chemistry-I	4	4
10	V	5B10 CHE	Core Course Practical-III Gravimetric Analysis	5	-
11	V	5B11 CHE	Core Course Practical-IV Organic Chemistry	5	-
12	V	5B12 CHE	Project /Industrial Visit	-	4
13	VI	6B13 CHE	Physical Chemistry –II	5	4
14	VI	6B14 CHE	Organic Chemistry-II	4	4
15	VI	6B15 CHE	Elective	4	4
16	VI	6B10&11CHE	Core Course Practicals –III&IV	5	6
17	VI	6B16 CHE	Core Course Practical- Physical Chemistry	5	4

Scheme Common (General) Courses

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

3A05PCH POLYMER CHEMISTRY I

Credits:3

Total Hours :54

Module-1 Introduction to Polymers (10 hrs)

Basic concepts- historical development- Present status-Classification of polymers- Nomenclature- Natural and synthetic polymers- Organic and inorganic polymers-Thermoplastics and thermo sets- Plastics, elastomers, fibers and liquid resins-Addition polymers and condensation polymers-Homopolymers and copolymers- linear, branched and cross linked polymers-graft and block co-polymers-characteristic features of each.

Basic concept of monomers-Functionality.

Module-2 Molecular weight of Polymers(12 hrs)

Importance of molecular weight control-arithmetic mean – Number average, weight average, Viscosity average- Polydispersity and PDI-Molecular weight distribution in polymers and its importance from the point of application – Degree of polymerization-Molecular weight and mechanical properties.

Module-3 Molecular forces and chemical bonding in Polymers(10 hrs)

Crystallinity and amorphous behavior of polymers- Tacticity in polymers-Isotactic, syndiotactic and atactic polymers- Thermal transition in polymers- T_g and T_m – Thermal transitions and associated properties-Determination of T_g -Dilatometric method, Calorimetric method – Glass transition temperature and molecular weight – Importance of T_g – Plasticizers and their action. Secondary bonding forces that exist in polymers.

Module-4 Polymer Solutions (08 hrs)

Criteria of solubility of polymers-Thermodynamics of polymer dissolution- effect of molecular weight on solubility – polymer fractionation – Fractional precipitation technique – Partial dissolution technique – Gel permeation chromatography-Gradient elution technique.

Module-5 Techniques of Polymerization (14 hrs)

Bulk polymerization – Solution polymerization – Suspension polymerization – Emulsion polymerization – Advantages and disadvantages of these techniques – comparison of the above. Batch and continuous process.

3A06PCH POLYMER CHEMISTRY II

Credits:3

Total Hours :54

Module-1 Characterization of Polymers (10 hrs)

Molecular weight determination – Method based on colligative property measurements – cryoscopy –ebullioscopy –osmometry –membrane osmometry –vapour-pressure osmometry – Methods based on viscosity. Measurements –viscometry –Light scattering method – ultracentrifuge technique –End group analysis –GPC method.

Thermal methods of analysis in polymers – TGA, DTA, DSC.

Module-2 Chemistry of Polymerization (10 hrs)

Addition polymerization –Free radical polymerization –Initiation, Propagation and termination –inhibitors and retarders.

Ionic polymerization –cationic and anionic –Living polymers. Co-ordination polymerization – Zeigler –Natta catalysts.

Condensation polymerization –Extend of reaction and DP –Carother's equation and its significance. Three dimensional polymerization –cross linking –gel point –Ring scission polymerization.

Module-3 Kinetics of Polymerization (10 hrs)

Kinetics of free-radical polymerization –Kinetic chain length and DP. Derivation for rate expression and expression for kinetic chain length and hence degree of polymerization.

Kinetics of polycondensation with polyester as example. Simple kinetic expression – catalised and uncatalised polycondensation.

Module-4 Natural Polymers (10 hrs)

Natural rubber –Structure and properties of NR –trans-poly –isoprene –Cellulose – Cellulose based polymers –Cotton, Rayon –Nitrocellulose –cellulose acetate. Shellac, Casein.

Module-5 Inorganic Polymers (14 hrs)

General properties –classification –Boron based polymers – Borazine, Polymeric boron nitride –Phosphorous based polymers –Polyphosphonitrilic chloride –polyphosphoric acids – phosphorous based net work polymers –Silicon based polymers – Organotin polymers .

Reference Books:

1. A text Book of Polymer Science –F.W.Billmeyer.
2. Polymer Science –V.R. Gowariker, N.V.Viswanathan, J.Sreedhar
3. Principles of Polymer Chemistry –P.J.Flory .
4. Rubber Technology –Maurice Morton
5. Plastic materials-J.A.Brydson
6. Macromolecules-H.G.Elias
7. Principles of Polymerization –G.Odian
8. Polymer Science and Technology –Joel R. Fried
9. Polymer Chemistry –Raymon B Sepmour
10. Principles of polymerization-F.Rooriquez

4A09PCH POLYMER CHEMISTRY III

Credits:3

Total Hours :54

Module-1 Commercial Polymers (10 hrs)

Plastics –Thermoplastics and thermosets: Manufacture, properties and applications of the following plastics - LDPE, HDPE, Polypropylene, Polystyrene PVC, PMMA, PAN, Polyacrylic acid, Polymethacrylic acid. Polyamides –Nylon 6.6 and Nylon 6. Aromatic polyamides –Nomex, Kevlar. Polyesters –PET. Unsaturated polyesters. Polycarbonates –Acetal resins –Polysulphones – PPO –Phenolic resins –Novalac formation – Resole formation. Urea – formaldehyde, Melamine – formaldehyde resins.

Module-2 Synthetic Rubbers (10 hrs)

Manufacture, general properties and applications of SBR, Polyisoprene, Polybutadiene, Butyl rubber, Ethylene –propylene rubber, Neoprene rubber, Speciality rubbers: Silicon rubbers, Nitrile

rubbers, Polyacrylic rubbers –Polyurethane rubbers –Hypalon –Fluorocarbon elastomers – Thermoplastic elastomer, reclaimed rubber, foam rubber.

Module-3 Polymer Degradation (15 hrs)

Type of degradation – Thermal degradation –factors effecting thermal stability –Polymer degradation involving substituent groups – mechanical degradation –Photodegradation – Photostabilizers –Degradation by high energy radiation Oxidative degradation –antioxidants.

Module-4 Plastic Processing (19 hrs)

Basic principles of processing –shape and size –processing parameters –their effects and behavior –Rheology of ideal fluids and polymers. Polymer compounding –additives –fillers, Plasticizers, antioxidants, Flame retardants, stabilizers, colourants etc.

Process techniques: Injection moulding, Compression moulding, Transfer moulding, Blow moulding, Extrusion moulding Rotational moulding, Calendering, Foaming, Laminating. Coating, Casting, Spinning and Thermoforming.

4A10PCH POLYMER CHEMISTRY IV

Credits:3

Total Hours :54

Module-1 Latex Technology (15 hrs)

Rubber latex –Latex processing – Preserved field latex-Latex concentration by processes like centrifuging and creaming –Preparation of Ribbed Smoked Sheets – Technically specified forms of rubber –Superior processing rubbers –Latex compounding –additives used –manufacture techniques of rubber goods from latex –dipping –casting and moulding –Latex form rubber.

Rubber processing –Mastication –Additives used in rubber compounding Rubber fabrication – Mixing –two roll mill –Internal mixers –calendering moulding – extrusion.

Vulcanization –Sulphur vulcanization and non –sulphur vulcanization. Unique properties of Rubber.

Module-2 Testing of Polymers and Polymer products. (15 hrs)

Need for testing, Need for Standards and specification –National and International standards – Organizations like ASTM, BIS, BS, DIN, ISO etc.

Mechanical properties: Short term strengths – Tensile properties, compression properties, flexural properties, shear properties, Impact resistance, toughness, tear resistance, abrasion resistance and hardness., scorch and cure rate.

Long term strength –m dynamic stress and strain properties and their measurements –creep, stress relaxation fatigue properties, flexing and resilience.

Module-3 Special Topics in Polymer Science (24 hrs)

Blends/Alloys –Composites –Examples and application in engineering, biochemical, agriculture, defense and aerospace.

Specialty polymers –Biopolymers, Conducting polymers, engineering polymers–applications. Pollution ,hazards in rubber industry and their control.

Plastic Waste management –Chemical recycling –incineration –Pyrolysis –mixed waste recycling – value addition and application development for recycled materials.

Reference Books:

1. A text Book of Polymer Science –F.W.Billmeyer.
2. Polymer Science –V.R. Gowariker, N.V.Viswanathan, J.Sreedhar
3. Principles of Polymer Chemistry –P.J.Flory
4. Rubber Technology –Maurice Morton
5. Rubber Technology and manufacuture. –C.M.Blow
6. Synthetic rubbers. –D.C. Blackley
7. Plastic materials –J.A.Brydson
8. Hand book of rubber Test method –R.P.Brown
9. Hand book of plastic Test method - R.P.Brown
10. High performance Polymers, their origin and development –Seymour R.B.Klrschenbaun, G.S.Elsevier.
11. Principles of polymerization-F.Rooriquez.

3A06(A)PCH POLYMER CHEMISTRY – PRACTICAL

Credits:0

Total Hours :36

1. Identification of Plastic and Rubbers (10 samples)

2. Preparation of Polymer – PMMA, Nylon6, 6., Polystyrene by mass polymerization, Polystyrene by Pearl polymerization, Polyacrylamide by Free radical polymerization, Polyacrylamide by Redox polymerization, Polyaniline, Phenol – formaldehyde resin, Urea- formaldehyde resin, Aniline – formaldehyde resin.

4A06(A)PCH POLYMER CHEMISTRY – PRACTICAL

Credits:4

Total Hours :36

1. Latex Analysis –Determination of Dry Rubber Content, Total solid content, Ammonia Content, pH of latex.
2. Relative Viscosity measurement of Polymer solutions
3. Analysis and estimation of phenolic group by bromination method.

MODEL QUESTION PAPER

3A06(A)PCH& 4A06(A)PCH Polymer Chemistry Practical

Time : 4 Hrs

Credit :4

Instruction: Candidate should submit bonafide record at the time of examination

1. Write in the first 5 minutes, in the separate sheet of paper provided a brief outline of the procedure you would adopt for the
2. Analyse systematically and qualitatively the given uncompounded polymer sample and identify it. Submit a report of the procedure and tests adopted for identification.
3. Convert the givenmonomer to

(Styrene to poly styrene / Methyl methacrylate to PMMA)

Submit the whole of the product for inspection.

4. Estimate the percentage(W/W)of ammonia in the given sample of Rubber Latex. You are supplied with analar Sodium carbonate and an approximately 0.1N Solution of Hydrochloric Acid.

Sd/-

Dr.K.Pradeep Kumar,

Chairman, BOS Chemistry (UG).