DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
CHHATRAPATI SAMBHAJINAGAR.

CIRCULAR NO.SU/B.Sc./CBC & GS/17/2024

It is hereby inform to all concerned that, the syllabi prepared by the Board of Studies/Ad-hoc Boards and recommended by the Dean, Faculty of Science & Technology, **Academic Council at its meeting held on 08 April 2024 has accepted the following Syllabi under the Faculty of Science & Technology as per Choice Based Credit Grading System** as appended herewith.

Sr.No.	Courses	Semester
1.	B.Sc. Chemistry (Optional)	Vth & VIth semester
2.	B.Sc. Analytical Chemistry (Optional)	Vth & VIth semester
3.	B.Sc. Polymer Chemistry (Optional)	Vth & VIth semester
4.	B.Sc.Biochemistry (Optional)	Vth & VIth semester
5.	B.Sc.Dairy Science & Technology (Optional)	Vth & VIth semester
6.	B.Sc.Microbiology (Optional)	Vth & VIth semester
7.	B.Sc. Botany (Optional)	Vth & VIth semester
8.	B.Sc. Computer Science (Optional)	Vth & VIth semester
9.	B.Sc. Computer Science (Degree)	Vth & VIth semester
10.	B.Sc.Information Technology (Optional)	Vth & VIth semester
11.	B.Sc.Information Technology (Degree)	Vth & VIth semester
12.	Bachelor of Computer Application (Optional)	Vth & VIth semester
13.	Bachelor of Computer Application (Degree)	Vth & VIth semester

This is effective from the Academic Year 2024-25 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Chhatrapati Sambhajinagar.
-431 004.
REF.NO.SU/2024/1786-94
Date:- 21.06.2024.

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Deputy Registrar,
Academic Section

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Copy forwarded with compliments to :-

1] **The Principal of all concerned Colleges,**
Dr. Babasaheb Ambedkar Marathwada University,

2] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**

Copy to :-

1] **The Director, Board of Examinations & Evaluation,** Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

2] The Section Officer,[B.Sc.Unit] Examination Branch, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

3] The Programmer [Computer Unit-1] Examinations, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

4] The Programmer [Computer Unit-2] Examinations, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

5] The In-charge,[E-Suvidha Kendra], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

6] The Public Relation Officer, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

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Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhaji Nagar

CBCGS Syllabus

B.Sc. Polymer Chemistry **(Optional)**

Semester V & VI

With effect from 2024-25

Prof. Pathan Mohd Arif Ali Khan
Chairman
Board of Studies in Chemistry,
Dr. Babasaheb Ambedkar Marathwada

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

Choice Based Credit System (CBCS) Curriculum

For Faculty of Science and Technology

Course Structure and Scheme of Examination

BSc. Three year Undergraduate Degree Program

Subject : **Polymer Chemistry**

Semester I								
	Course Code	Course Title	Teaching hr/ Week	Credits	Scheme of Examination			
					Max Marks	CIA	UA	Min Marks
Optional (DSC-1C) Core Courses	PCH 111	Core Course (Theory Paper I) **Basic concepts in Polymer chemistry-I**	2	2	50	10	40	20
	PCH 112	Core Course (Theory Paper II) **Basic concepts in Polymer chemistry-II**	2	2	50	10	40	20
	PCH 121	Lab Course 1 (PCH-111 -PCH-112)	3	1.5	/,50	10	40	20
Total Credits for Semester I: 5.5 (Theory:04 ; Laboratory: 1.5)								

Semester II								
	Course Code	Course Title	Teaching hr/ Week	Credits	Scheme of Examination			
					Max Marks	CIA	UA	Min Marks
Optional (DSC-1D) Core Courses	PCH 211	Core Course (Theory Paper III) **Natural polymers**	2	2	50	10	40	20
	PCH 212	Core Course (Theory Paper IV) **Raw material of polymers and polymerization reaction**	2	2	50	10	40	20
	PCH 221	Lab Course 2 (PCH-211 PCH-212)	3	1.5	50	10	40	20
Total Credits for Semester IV: 5.5 (Theory:04; Laboratory: 1.5)								

Practicals exam of both I and II semester will be conducted at the end of second term

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Polymer Chemistry

Semester III								
	Course Code	Course Title	Teaching hr/ Week	Credits	Scheme of Examination			
					Max Marks	CIA	UA	Min Marks
Optional (DSC-1C) Core Courses	PCH 311	Core Course (Theory Paper V) **Kinetics of polymerization**	2	2	50	10	40	20
	PCH 312	Core Course (Theory Paper VI) **Chemistry of polymer material- I**	2	2	50	10	40	20
	PCH 321	Lab Course 3 (ACH-311)	3	1.5	50	10	40	20
	PCH 322	Lab Course 4 (PCH-312)	3	1.5	50	10	40	20
SEC	CHE 313 Select any one from SEC-1A & SEC-1B	CHE 313 SEC-1A **Laboratory safety and Laboratory Practices**	2	2	50	10	40	20
		CHE 313 SEC-1B **Water Analysis**	2	2	50	10	40	20
Total Credits for Semester III: 07+02 (Theory:04+02; Laboratory: 03)								

Semester IV								
	Course Code	Course Title	Teaching hr/ Week	Credits	Scheme of Examination			
					Max Marks	CIA	UA	Min Marks
Optional (DSC-1D) Core Courses	PCH 411	Core Course (Theory Paper VII) Thermodynamics of polymer and polymer solution	2	2	50	10	40	20
	PCH 412	Core Course (Theory Paper VIII) Chemistry of polymer material- I	2	2	50	10	40	20
	PCH 421	Lab Course 5 (PCH-411)	3	1.5	50	10	40	20
	PCH 422	Lab Course 6 (PCH-412)	3	1.5	50	10	40	20
SEC	CHE 413 Select any one from SEC-2A & SEC-2B	CHE413 SEC-2A **Pharmaceuticals Chemistry**	2	2	50	10	40	20
		CHE413 SEC-2B **Industrial Fermentation & Alcohol Technology**	2	2	50	10	40	20
Total Credits for Semester IV: 07+02 (Theory:04+02; Laboratory: 03)								

Practicals exam of both III and IV semester will be conducted at the end of second term

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Semester V								
	Course Code	Course Title	Teaching hr/ Week	Credits	Scheme of Examination			
					Max Marks	CIA	UA	Min Marks
Optional (DSC-1C) Core Courses	PCH 511	Core Course (Theory Paper IX)	2	2	50	10	40	20
	PCH 512	Core Course (Theory Paper X)	2	2	50	10	40	20
	PCH 521	Lab Course 7 (PCH-511)	3	1.5	50	10	40	20
	PCH 522	Lab Course 8 (PCH-512)	3	1.5	50	10	40	20
SEC	CHE 513 Select any one from SEC-3A & SEC-3B	CHE 513 SEC-3A	2	2	50	10	40	20
		CHE 513 SEC-3B	2	2	50	10	40	20
Total Credits for Semester III: 07+02 (Theory:04+02; Laboratory: 03)								

Semester VI								
	Course Code	Course Title	Teaching hr/ Week	Credits	Scheme of Examination			
					Max Marks	CIA	UA	Min Marks
Optional (DSC-1D) Core Courses	PCH 611	Core Course (Theory Paper XI)	2	2	50	10	40	20
	PCH 612	Core Course (Theory Paper XII)	2	2	50	10	40	20
	PCH 621	Lab Course 9 (PCH-611)	3	1.5	50	10	40	20
	PCH 622	Lab Course 10 (PCH-612)	3	1.5	50	10	40	20
SEC	CHE 613 Select any one from SEC-4A & SEC-4B	CHE 613 SEC-4A	2	2	50	10	40	20
		CHE 613 SEC-4B	2	2	50	10	40	20
Total Credits for Semester IV: 07+02 (Theory:04+02; Laboratory: 03)								

Practicals exam of both V and VI semester will be conducted at the end of second term

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BSc V Semester
DSC IA (1) Core course (Theory Paper IX)
PCH-511: Structure and properties of polymers-I

Credits 02 **45 Lectures**

1. Adhesives:

introduction, classification, Adhesive Action, development of action and strength, factors affecting, adhesive Action and physical binding process, Preparative methods of adhesive and comparative applications of adhesives.

2. Inorganic and Inorganic-Organic polymers:

Introduction to inorganic Polymers: Cement: Portland and other, Silicates: Network, Layer, Chain; Asbestos, Polysilanes, Polysulfur, Polymeric Carbon: Diamond, Graphite, Carbon fibers: internal cyclization, black orlon, CNTs, structures, Ceramics, Zeolites. Polyphosphazenes, organotin condensation polymers, synthesis, properties structure and applications, synthesis of silicon fluid, Silicon resins, silicon elastomers, polysiloxanes, types, preparation, examples of polysiloxanes, their properties, and applications.

3. **Spectroscopic studies of polymers:** IR Spectroscopy of polymer, sample preparation for IR measurements, XRD, NMR and mass Spectroscopy: MALDI-MS, Introduction to Electron microscopy: SEM and TEM; Scanning probe microscopy: STM, AFM

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BSc V Semester

DSC IA (2) Core course (Theory Paper X)

PCH-512 : Advanced Polymer Chemistry – I

Credits 02 **45 Lectures**

1. Methods of preparation, properties and applications of: polystyrene, polyacetals, poly ketals, polybenzimidazole

2. Coordination polymers:

Introduction and survey of catalyst, Ziegler-Natta catalysis, component and their interactions. Polymerization reactions, mechanism of Ziegler-Natta polymerization catalyst, Metathesis polymerization reaction with Ziegler-Natta Catalysts. Grubb's catalyst: metathesis reaction with mechanism, ring opening metathesis polymerization (ROMP).

3. Copolymerization:

Introduction, classification, copolymerization behaviour, reactivity ratios, free radical copolymerization, effect of structure on reactivity of free radical copolymerization, preparation of block and graft copolymers, polymer blends: immiscible and miscible blends, Interpenetrating polymer networks, Dendrites. Technical significance of Copolymerization

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BSc V Semesters
Core course (Lab course 7)
PCH-521 Polymer Chemistry

Credits 1.5 **60 Lectures**

1. IR spectroscopic analysis of natural and synthetic polymers. (5 experiments)
2. Determination of Crystallinity by IR spectroscopy. (3 Experiments)
3. Preparation of silicones.
4. Mass spectroscopic analysis of polymer samples.
5. Analysis (size, shape, morphology) and group discussion of SEM, TEM, STM and AFM images of polymers and polymer nanocomposite samples. (4 Experiments)
6. Drawing structures of different polymers and polymer reactions using chemical structure drawing softwares. (Polyphosphazenes, Silicones, Polysilanes, Organotin condensation polymers, etc.). (3 Experiments)

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BSc V Semester
Core course (Lab course 8)
PCH-522 Polymer Chemistry

Credits 1.5 **60 Lectures**

1. Preparation of Polypropylene using Ziegler-Natta Catalysts.
2. Polymerization of styrene with Ziegler-Natta Catalysts.
3. Polymerization of Butadiene with Ziegler-Natta Catalysts.
4. Synthesis of Poly(1-pentylene) by Metathesis polymerization of cyclopentene with Ziegler-Natta Catalysts.
5. ROMP of norborn-5-ene-2-ethanol with a Grubbs catalyst.
6. Preparation of Polymer Blends from the Melt
7. Preparation of Polymer Blends from Solution
8. Preparation of polymer blends (ABS) by Coprecipitation of Polymer Latices.
9. Preparation of Polystyrene-Polybutadiene blend by polymerization of Styrene in the solution containing Polybutadiene.
10. Drawing structures of different polymers and polymer reactions using chemical structure drawing softwares. (Ziegler-Natta cataly, Grubbs metathesis polymerization, etc.). (3 Experiments)

References:

1. Malcolm P. Stevens, Polymer chemistry-An introduction, Oxford Uni. Press.
2. The Purple Book, Compendium of Polymer Terminology and Nomenclature, IUPAC Recommendations, Edited by Richard G. Jones, Jaroslav Kahovec, Robert Stepto, Edward S. Wilks, Michael Hess, Tatsuki Kitayama, W. Val Metanomski RSC Publishing
3. Encyclopedia of Physical Science and Technology- Polymers, Academic Press
4. F. W. Billmayer, Text book of Polymer Science, 3rd edition, John Wiley &Sons
5. V. R. Gowariker, N. V. Viswanathan & J. Sreedhar, Polymer Science, New Age International Publishers.
6. Polymer Chemistry- M. G. Arora and M. Singh
7. P. Bahadur & N. V. Sastry, Principles of Polymer Science, Narrora Publishing House, 2nd Edition, New Delhi.
8. Premamoy Ghosh, Polymer Science & Technology, 3rd edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
9. Polymer Science and Technology – A. Ghosh
10. Organic Polymer Chemistry- K J Saunders, Chapman and Hall, London.
11. Physical Chemistry of Polymer- A Tager
12. Physical Chemistry of Macromolecules- D D Deshpande
13. G. Odian, Principles of polymerization, John Wiley & Sons.

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14. G. S. Misra, Introductory Polymer Chemistry New age International Publishers & Distributors, New Delhi
15. V. K. Ahluwalia & A. Misra, Polymer Science-A Text Book, CRC Press
16. Experiments and calculations in engineering chemistry- S S Dara
17. J. R. Fried, Polymer Science & Technology, Prentice Hall of India Pvt. Ltd, New Delhi
18. Inorganic polymers by G. R. Chatwal, Himalaya Publishing House, 1st Edition.
19. Experiments in Polymer Science, D. G. Hundiwale, V. D. Athawale, U. R. Kapadi and V. V. Gite, New Age International Publication.
20. A Laboratory Manual of Polymers: Volume I, S. M. Ashraf, Sharif Ahmad, Ufana Riaz, I K International Publishing House Pvt. Ltd., New Delhi
21. Carraher's Polymer Chemistry: tenth edition, Charles E Carraher, Jr., CRC Press
22. Polymer Chemistry by Paul C. Hiemenz, Timothy P. Lodge, CRC Press
23. Polymer Synthesis: Theory and Practice, Dietrich Braun, Harald Cherdron, Matthias Rehahn, Helmut Ritter, Brigitte Voit, Springer
24. Principles of Polymer Chemistry, A. Ravve, Springer
25. Mohamed A. Fahim, Taher A. Alsahhaf, and Amal Elkilani; Fundamentals of Petroleum Refining, Elsevier.
26. Handbook of Petrochemical Processes, James G. Speight, CRC Press
27. Latex technology, D. Kumar, R. Chandra, Dhanpat Rai Publishing
28. The Stereochemistry of Macromolecules Volume 1, Edited by A. D. Ketley, Marcel Dekker Inc., New York
29. March's Advanced Organic Chemistry, Michael B. Smith, Jerry March, Wiley-Interscience.

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Note **Select any one Skill enhancement course from SEC-3A and SEC-3B**

SEC-3A
(1-Cosmetics)

(Theory Paper Credits: 2, 45 Lectures)

UNIT I

Classification of cosmetic and cosmeceutical products Definition of cosmetics as per Indian and EU regulations, Evolution of cosmeceuticals, from cosmetics, cosmetics tis quasi and OTC drugs

Cosmetic excipients: Surfactants, rheology modifiers, humectants emollients, preservatives. Classification and application

Skin: Basic structure and function of skin.

Hair: Basic structure of hair. Hair growth cycle.

Oral Cavity: Common problem a .sociat d with teeth and gums.

UNIT II

Principles of formulation and building blocks of skill care products:

Face wash,

Moisturizing cream, Cold Cream, Vanishing cream and their advantages and disadvantages. Application of these products in formulation of cosmecuticals.

Antiperspants & deodorants- Actives & mechanism of action.

UNIT III

Principles of formulation and building blocks of Hair care products:

Conditioning shampoo, Hair conditioner, anti-dandruff shampoo.

Hair oils.

Chemistry and formulation of Para-phylene diamine based hair dye.

Principles of formulation and building blocks of oral care products:

Toothpaste for bleeding gums, sensitive teeth. Teeth whitening, Mouthwash.

References

1)Harry's Cosmeticolcgy, Wilkinson, Moore, Seventh Edition, George Godwin.
2)Cosmetics - Formulations, Manufacturing and Quality Control, .P.P. Sharma, 4th Edition, Vandana Publications Pvt. Ltd., Delhi.
3)Text book of cosmelicology by Sanju Nanda & Roop K, Khar, Tata Publishers.

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SEC 3B
(2- Jam, Jelly, Sauce And Ketchups)
(Theory Paper Credits: 02, 45 Lectures)

UNIT I : **15 Lectures**

Food safety education and training: introduction, need for education and training,
Food Safety and Standards Authority in India (FSSAI): Introduction, functions & duties, provisions for food products
Food laws and regulations:
Prevention of food adulteration act (PFA act) - introduction, features of act, implementation
Essential Commodity Act (ECA) - Fruit Product Order (FPO), Vegetable Oil Product Order,
Export act, Bureau of Indian Standards Act (BIS), Agmark, ISI mark, ISO, FAO, WHO

UNIT II : **15 Lectures**

a) JAM, JELLY, MARMALADE :

Introduction Jam, Jelly, Marmalade, Definition of Jam and Jelly, Difference between Jam and Jelly. Colloidal System in Jelly, Chemistry of Jam making, Structure of Pectins, Colors and Preservatives used in jams, jellies and marmalades.

b) Sauce and Ketchups Introduction and Colors :

Introduction Brief History, Definition and concept of Sauce and Ketchup, Principle, Components and Ingredients of sauces and ketchups, Chemistry of Ketchup, Different Types of Sauce and Ketchups, Difference between Sauce and Ketchup, Additive edible colors types and examples

UNIT III : **15 Lectures**

Preservatives in Sauce and Ketchups,

Definition of Chemical Preservatives, their advantages and disadvantages; Use and proportions of different preservatives in Ketchup and Sauces, Edible Colors and their advantages and disadvantages, Different types of Sauces. Technique of Sealing of Bottles or jars for commercial use

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BSc VI Semester

DSC 1A(1) Core course (Theory Paper XI)

PCH-611 : Structure and properties of Polymers-II

Credits 02 **45 Lectures**

1. Rheology and mechanical properties of polymers:

Concept of rheology, viscous flow non-newtonian fluids, Hooks equation, viscoelasticity, Maxwell model, Vioget model, deformation behaviour of polymer material, relaxation and retardation. flexible behaviour of polymer in flow

2. Plastic processing techniques

Introduction, principles of processing, mixing operation, extruders and extrusion process, compression, injection, transfer, Extrusion, Blow moulding, Injection moulding, Compression moulding, Rotational moulding; Calendering, Thermoforming and Laminating, factors affecting the processing,

3. Fibre Technology:

Natural and synthetic fibers, fiber properties, tenacity, moisture content, and moisture regain, script, electrical and mechanical crease, crease-resistant, and retaining properties of fabric stability. Processing of fibre: Spinning and fiber production: melt spinning, dry spinning, wet spinning, reaction spinning, fiber after treatment, processing properties of polyamides, PET

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BSc VI Semester

DSC 1A(2) Core course (Theory Paper XII)

PCH-612 : Advance polymer chemistry - II

Credits 02 **45 lectures**

1. Elastomers:

Vulcanization of rubber, reinforcement, compounding and elastomeric properties. Elastomer processing.

Preparation, properties and applications of: ABS, SBR, nitrile (NBR), butyl rubber, butadiene rubber, and neoprene Rubber and ethylene propylene rubber (EPM), ethylene propylene diene monomer rubber (EPDM), Natural rubber.

2. Polymer composites and fillers

Introduction, Organic and Inorganic fillers, classifications, types of composites, nanocomposites, laminar composites. Mechanical properties of composites, preparation and applications of composites

3. Polymer industries and environment:

Effluents and their disposal, plastic wastes, recycling of plastic waste: primary and secondary recycling, chemical recycling, biodegradable polymers,

4.Polymer materials for special applications:

Introduction, Hydrogels in drug delivery systems, polymer supports for reagents, catalysts. Conductive polymeric materials: photoconductive and photonic polymers, electrically conductive polymers, nanowires.

Polyelectrolytes: Superabsorbents, Salts of crosslinked polyacrylic acid copolymer, structures, synthesis, properties, and applications.

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BSc VI Semester
Core course (Lab course -9)
PCH-621 Polymer Chemistry

Credits 1.5 **60 Lectures**

1.Plastic processing techniques: Moulding

2.Preparation of laminates. (2 experiments)

3.Polymer film formation.

4.Injection moulding.

5.Blow moulding.

6.Compression moulding.

7.Preparation of fibers by melt-spinning.

8.Preparation of fibers by solution Spinning.

9.Preparation of Films from solution

10.Preparation of biodegradable polymers.

11.Preparation of conductive composites of Polycarbonate with Carbon black.

12.Preparation of superabsorbent polyelectrolytes.

13.Drawing structures of different polymers and polymer reactions using chemical structure drawing softwares. (Salts of Polylactide, etc.). (3 Experiments)

14 Industrial visit and a report on industrial visit.

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BSc VI Semester
Core course (Lab course -10)
PCH-622 Polymer Chemistry

Credits 1.5 **60 Lectures**

Project

Project work based on the any topic of polymers

References:

1. Malcolm P. Stevens, Polymer chemistry-An introduction, Oxford Uni. Press.
2. The Purple Book, Compendium of Polymer Terminology and Nomenclature, IUPAC Recommendations, Edited by Richard G. Jones, Jaroslav Kahovec, Robert Stepto, Edward S. Wilks, Michael Hess, Tatsuki Kitayama, W. Val Metanomski RSC Publishing
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4. F. W. Billmayer, Text book of Polymer Science, 3rd edition, John Wiley &Sons
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28. The Stereochemistry of Macromolecules Volume 1, Edited by A. D. Ketley, Marcel Dekker Inc., New York
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Note **Select any one Skill enhancement course from SEC4A and SEC4B**

SEC-4A

(1. Industrial waste water treatment)

(Theory Paper Credits: 02, 45 Lectures)

Wastewater Treatment:

Pre & Primary Treatment - screening, comminuting, grit removal, flow measurement. Primary sedimentation Equalization, Proportioning, Neutralization, Oil separation by Floating-Waste Reduction-Volume Reduction-Strength Reduction. Waste Treatment Methods - Nitrification and De-nitrification-Phosphorous removal –Heavy metal removal, Membrane Separation Process - Air Stripping and Absorption Processes, Special Treatment Methods - Disposal of Treated Waste Water.

Secondary Treatment: Activated sludge. Trickling filters. Stabilisation pond. Up-flow anaerobic sludge blanket reactor.

Tertiary Treatment: Wastewater disposal and reuse. Nutrient removal. Solid removal. Ozone treatment. Reverse osmosis. Ultraviolet filtration. Ion exchange. Wastewater disposal. Water reuse. Concept of common effluent treatment plant (CETP).

Books for Reference:

1) Natural Hazards-Local, National, Global: G. F. White, Oxford University Press.

2) Laboratory Manual for the Examination of Water, Waste water and soil: H. H. Rupa and H. Krist;

VC H Publication

3) Environmental Impact Analysis Handbook: J. G. Rau and D. C. Wooten; McGraw-Hill Book Co.

4) Environmental Impact Assessment, L. W. Canter, McGraw Hill Publication,

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SEC-4B

(2.Purification and Separation techniques)

(Theory Paper Credits: 02, 45 Lectures)

Principles, efficiency and techniques involved in

1. Filtration,
2. Distillation,
3. Fractional distillation
4. Steam distillation
5. Vacuum distillation
6. Solvent extraction

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