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P. R. GOVERNMENT COLLEGE
(AUTONOMOUS)
KAKINADA

(Affiliated to Adikavi Nannaya University, Rajamahendravaram)

DEPARTMENT OF CHEMISTRY

B.Sc. Petrochemicals Syllabus under CBCS

BOARD OF STUDIES

2021-2022

P. R. Govt. College (A), Kakinada

Recommended Composition of the Board of Studies of Petrochemicals

And it's Functions of an Autonomous College

(AY 2021-22)

I Composition

i. **Head of the Department concerned (Chairman):**

Sri. Rambabu Vasamsetti, M.Sc.B.Ed,SET

ii. **The entire faculty of each specialization.**

1. Dr. D. Rama Rao, M.Sc., B. Ed., M.Phil. Ph.D.
2. Dr. D. Chenna Rao M.Sc., Ph.D.
3. Sri. V.Sanjeeva Kumar M.Sc, NET
4. Sri. T.V.V. Satyanarayna M.Sc.B.Ed,SET
5. Sri. P. Vijaya Kumar M.Sc., NET
6. Sri. G. Pavani, M.Sc.B.Ed,SET
7. Dr. T. Uma Maheswara Rao MSc, Ph.D.
8. Dr. N. Bujjibabu MSc., Ph. D
9. Dr. Ch. Praveen MSc., Ph.D
10. Sri. G. Sai Subrahmanyam, M.Sc.,

iii. **One expert to be nominated by the Vice-Chancellor from a panel of six recommended by the College Principal**

Dr. M. Trinadh, Lecturer in Chemistry, GDC (A), Rajahmundry

iv. **One expert in the subject from outside the college to be nominated by the Academic Council**

Dr.V. Narayana Rao, Lecturer in Chemistry, GDC Perumallapuram.

v. **One representative from industry/ Corporate Sector/ allied area relating to Placement.**

Dr. B. Ramesh Babu, Founder & M. D., BogaR Laboratories, Peddapuram.

vi. **One postgraduate meritorious alumnus to be nominated by the Principal**

The chairman, Board of Studies, may with the approval of the Principal of the College, Co-opt.

Dr. K. Raghava Chari, M.Sc., M.Phil., Ph.D

II. Term.

The term of the nominated members shall be two years.

III. Meeting

The Principal of the College shall draw the schedule for meeting of the Board of Studies for different Departments. The meeting may be scheduled as and when necessary but at least once a year.

IV. Functions

The Board of Studies of a Department in the College shall:

a) Prepare syllabus and various courses keeping in view the objectives of the College interest of the stakeholders and national requirement for consideration and approval of the Academic Council.
b) Suggest methodologies for innovative teaching and evaluation techniques.
c) Suggest panel of names to the Academic Council for appointment of examiners.
d) Coordinate research, Teaching, Extension and other academic activities in the Department/College.

P.R. GOVT.COLLEGE (A), KAKINADA

Department of Petro chemicals

Minutes of board of studies (BOS) meeting 2021-22 on 02. 12. 2021 at 3.00 PM

Meeting of Board of Studies in Petro Chemicals is convened on 02 December 2021 through offline at P.R. Govt. College (A), Kakinada, at 3.00 PM.

Venue: Conference Hall, Dt: 02-12-2021, Thursday – 3.00 PM.

The Principal Dr. B.V. Tirupanyam, Chairman, Sri V. Rambabu, University Nominee, Dr. M. Trinadh, Lecturer in Chemistry, Govt. College (Autonomous), Rajamahendravaram, Industrialist Dr. B. Ramesh Babu, Founder & M.D., BogaR laboratories, Peddapuram, Subject Expert Dr.V. Narayana Rao, Lecturer in Chemistry, Government Degree College Perumallapuram, all the faculty members of Chemistry Department and student alumni attended the meeting.

Agenda:

- To discuss the Semester System and Choice Based Credit System (CBCS) being implemented for the past 06 years, i.e., w.e.f. 2015-16.
- To discuss and approve the Continuation/Modifications of the syllabus for the Odd & Even Semesters of I, II & III Years for 2021-22.
- Grant of Extra credits for Online SWAYAM MOOCs etc.
- Syllabus, Model Question Papers and Model Blue Prints for I, II, III, IV, V and VI Semesters.
- Teaching learning methodology by 60:40 (External: Internal) ratio for the present II- and III-Year Students and 50:50 (External: Internal) ratio I Year Students w.e.f. 2021-22.
- Panel of paper setters and examiners.
- Proposals for Community Service Projects/Extension activities for the benefit of the society.
- Department action plan for 2021-22.
- To discuss and resolve the minor modifications/refinement if any, in the Chemistry cluster electives CI, CII & CIII as majority of the students opting this cluster as their choice.

Any Other Proposal with the Permission of the Chairman.

Resolutions:

The following agenda items are discussed and resolutions are made.

1. It is resolved to continue choice based credit system in the chemistry combination programmes as per the directions of the CCE, Vijayawada to the first year and second year and final year student's w.e.f. 2018-19.

2. It is resolved to approve the Continuation/Modifications of the syllabus for the Odd & Even Semesters of I, II & III Years for 2021-22.

3.It is resolved to encourage students to active participation in various activities and give extra credits for students after successful completion of a particular activity such as SWAYAM, MOOCS etc., (Annexure –II)

4.It is Resolved to follow 60%-40% external and internal w.e.f. 2017-2018 admitted batches and it continued in present second and third year students.

5. It is resolved to follow 50%-50% external and internal for first year w.e.f 2021-22 admitted batch.

6. It is resolved to allot 50 marks project work for final year students in chemistry preferably in cluster paper C - 3 practical's, w.e.f 2019-20 in accordance with APSCHE.

7. It is resolved to conduct departmental activities such as OZONE DAY, CHEM FEST, CHEMISTRY DAY and SCIENCE DAY. (Annexure-I)

8.It is resolved to implement the recommended andragogy for the first semester 2021-22

9.Resolved to conduct practical examinations semester wise.

10.It is resolved to organize guest lectures by eminent professors.

11.Resolved to implement pass minimum for internal assessment for CBSE pattern students as the pattern is learner oriented.

12.It is resolved to maintain status quo for same question paper pattern in II, III years.

The following paper setters are recommended

1. Sri. U. Sai Krishna, Govt. College(A), Rajamahendravaram.
2. Dr. M. Trinadh, Govt. College(A), Rajamahendravaram
3. Dr. V. Narayana Rao, GDC, Perumallpuram.
4. Sri. M. Sudhakar, Govt. College(A), Rajamahendravaram.
5. Sri. K. Anand, GDC, Pithapuram.
6. Dr. CH. Vijay Vardhan, GDC, Perumallpuram.
7. Sri B. Surendra, GDC, Tadepaliigudem.

Signatures of the members who attended the

Board of studies in Petrochemicals on 02.12.2021 at 3: 00 PM

S.No.	Name of the member	Designation	Signature
1	Sri. Rambabu Vasamsetti	Chairman, Board of Studies, Lecturer in charge	
2	Dr. M.Trinadh	University Nominee Lecturer in Chemistry, GDC(A),Rajahmundry	02/12/2021
3	Dr.V. Narayana Rao	Subject Expert Lecturer in Chemistry, GDC Perumallapuram	02/12/21
4	Dr. B. Ramesh Babu	Industry expert Founder & M. D., BogaR Laboratories, Peddapuram.	
5	Dr. K. Raghava Chari	Alumnus, Retd. Principal,	
6	Dr.D.RamaRao	Member Lecturer I/c- Dept. of Chemistry	
7	Dr.D. ChennaRao	Member Lecturer in Chemistry	
8	Sri. V. Sanjeeva Kumar	Member Lecturer in Chemistry	
9	Sri. T. V. V. Satyanarayna	Member Lecturer in Chemistry	
10	Sri. P. Vijaya Kumar	Member Lecturer in Chemistry	
11	Sri.G. Pavani	Member Lecturer in Chemistry	2/12/21
12	Dr.T. Uma Maheswara Rao	Member Lecturer in Chemistry	
13	Dr. N. Bujji Babu	Member Lecturer in Chemistry	
14	Dr. Ch. Praveen	Member Lecturer in Chemistry	2/12/201
15	Sri. G. Sai Subrahmanyam	Member Guest Faculty in Petrochemicals	

ACTION PLAN BOS MEETING – PETROCHEMICALS HELD ON 02 - 12 - 2021.

Department activities for 2021-22 Academic year.

Annexure I

S.No.	Month	Activity Proposed	Faculty Member of In charge
1.	**NOV-21**	Departmental staff meeting to review admissions and faculty recruitment	All Faculty members
2.	**NOV-21**	Preparation of curricular plans, time-tables etc.,	All Faculty members
3.	**DEC-21**	Bridge classes	All Faculty members
4.	**DEC-21**	Student awareness programs on ragging & eve teasing - consequences, self-discipline.	All Faculty members
5.	**DEC – 21**	World AIDS Day	All Faculty members
6.	**JAN-22**	Career guidance, higher education opportunities etc.,	All Faculty members
7.	**JAN-22**	Chemistry day & Chem. Fest	All Faculty members
8.	**FEB – 22**	Study tour / Field trips	All Faculty members
9.	**FEB – 22**	NATIONAL SCIENCE DAY	All Faculty members
10.	**MAR-22**	Guest Lecture	All Faculty members

1. Organizing National/ State level seminars/Workshops/ Conferences/ Training programs etc. With topics and other details.

i). Staff development programs
ii) Awareness on OZONE protection
iii) National Chemistry day
iv) National Science day 2020
v) Guest lectures / Invited Talks
vi) Training on Soil analysis
vii) Training on water analysis

2. Change of modules in the syllabus content.

3. Plan for utilization of funds for Autonomous /CPE / Other grants available for arranging guest lectures, faculty improvement programs, study tours, equipping laboratories, reference books & other necessary teaching-learning material with ICT enabled teaching.

I. Study visits/ Field tours to Final year students: **Rs. 20,000**

1. National Institute of Hydrology, Kakinada.

2. SAR Chandra Environ Solutions, Kakinada.

3. ONGC mini refinery, Tatipaka.

4. Soil analysis laboratory, Samalkot.

5. Venky parenteral, Yanam

6. Any other relevant field visits

II. Lab equipment's: **Rs. 2, 00,000**

Lab equipment's required to conduct Practical's and to give hands on training to the students in order to build skill and confidence in the area of Petrochemicals and petroleum products.

III. Reference books & other necessary teaching – learning material: **Rs. 10,000**

IV. Guest Lectures / Invited talks: **Rs. 15,000**

4. Plan for organizing subject oriented community outreach programs & allocation of necessary funds. (Mandatory for each Department)

i) Awareness programs on various social / Health issue Rs. 10,000

5. Introduction of new programs - Certificate courses. Rs. 10,000

6. Any other program that enhances the learning capacity of students and their employable & knowledge skills

7. Examination reforms if any,

8. Suggest panel of examiners/paper setters & other experts/nominees for BOS deliberations.
   1. Sri. U. Sai Krishna, Govt. College(A), Rajamahendravaram.
   2. Dr. M. Trinadh, Govt. College(A), Rajamahendravaram
   3. Dr. V. Narayana Rao, GDC, Perumallpuram.
   4. Sri. M. Sudhakar, Govt. College(A), Rajamahendravaram.
   5. Sri. K. Anand, GDC, Pithapuram.
   6. Dr. CH. Vijay Vardhan, GDC, Perumallpuram.
   7. Sri B. Surendra, GDC, Tadepaliigudem.

Semester wise/ Paper wise Marks / Credits allotted.

YEAR	SEMESTER	PAPER	TITLE	MARKS	CREDITS
I	I	I	Fundamentals of Petroleum Production	100	04
			Practical – I	50	01
	II	II	Modern Petroleum Refining Processes	100	04
			Practical – II	50	01
II	III	III	Introduction to Chemical Engineering	100	04
			Practical – III	50	01
	IV	IV	Heat Transfer and Polymers	100	04
			Practical – IV	50	01
		V	Mass Transfer operations	100	04
			Practical – V	50	01
III	V	V	Mass Transfer operations	100	03
			Practical – V	50	02
		VI	Petrochemicals-I	100	03
			Practical – VI	50	02
		VII	Petrochemicals II (Elective)	100	03
			Practical - VII	50	02
Cluster	VIII(C)		VIII-C -1: Petrochemicals -III	100	03
			VIII-C-2 : Manufacturing Processes of Polymrs, Flow of fluids	100	03
			VIII-C-3:Testing and processing Techniques of Polymers	100	03
			Practical –VIII	50	02
			Practical –IX	50	02
			Practical –X: Project Work	50	02

GUIDELINES FOR ALLOTMENT OF EXTRA CREDITS

S.No.	Activity	Details of achievement	Credits
1	MOOC Course	**III**	Total credits achieved will be considered
2	NCC	B CERTIFICATE	2
		Participation in National Camp after 'B' certificate	3
		C certificate	4
		Adventure camp/RD parade along with 'B'	5
		Failed in B certificate Examination	1
3	Sports	Intercollegiate selection	2
		South zone selection	3
		All India participation	4
		Winning medals in all India competitions	5
4	NSS	40% attendance in regular NSS activities	1
		50% attendance with Community Service	2
		Conduct of survey/Youth exchange/RD	3
5	JKC	Enrollment and training	1
		Campus recruitment local level	2
		MNCs/reputed companies	3
6	Community service	Participation in community service by departments (outreach programmes)	2
7	Cultural activity	Winning medals at state level-2, District level-1	2 1
8	COP/Add on Course	Pass in Certificate Exam-1, Diploma-2	1 2

Course Structure:

All theory papers will have 4 hours per week and practical's will have 2 hours per week up to Semester IV (Second year). In final year all theory papers will have 3 hours per week and practical's will have 2 hours per week in Semester V and V I (Final year).

Each Theory Paper shall be of 100 marks and Practical Paper shall be of 50 marks.

Total Number of Papers: 21

Mathematics	: 7Papers
Chemistry	: 7Papers
Petrochemicals	: 7 Papers

Objectives and outcome of the course Petrochemicals

To give basic knowledge and awareness on petroleum and petrochemical products to the undergraduate level students, so that maintains linkages with Industries and research laboratories to expose the students to higher levels of knowledge and application of chemistry and then to provide job opportunities to the students in different industries.

With this impression the department of chemistry, P R Govt. College (A), introduced Mathematics, Chemistry and petrochemicals (MCPC) group in 1998-99. The objective of this course

The objective of B.Sc. Petrochemicals course is to teach students the basics about petroleum, petrochemicals and their processes. This subject gives student detailed information about petroleum and its formation.

In this three-year course spread over six semesters, there are 10 papers of Petrochemicals 7 papers of chemistry and 7 papers of Mathematics.

After graduating in Petrochemicals the students can pursue academics in Chemistry, Petroleum engineering, Petrochemicals and other disciplines of inter- disciplinary sciences. They can also use it as a stepping stone to different chemical, petrochemical and fertilizer in industries

Program Outcomes B.Sc. (Chemistry):

Undergraduate students upon graduation with a B.Sc. degree in chemistry:

PO : 1	Have firm foundations in the fundamentals and application of current chemical and scientific theories.
PO : 2	An understanding of major concepts, theoretical principles and experimental findings in chemistry.
PO : 3	Are able to design, carry out, record and analyze the results of chemical experiments
PO : 4	Are able to use modern instrumentation and classical techniques, to design experiments, and to properly record the results of their experiment.
PO : 5	Are skilled in problems solving, critical thinking and analytical reasoning.
PO : 6	Are able to identify and solve chemical problems and explore new areas of research.
PO : 7	Are able to use modern library searching and retrieval methods to obtain information about a topic, chemical, chemical technique, or an issue relating to chemistry.
PO : 8	Knows the proper procedures and regulations for safe handling and use of chemicals and can follow the proper procedures and regulations for safe handling when using chemicals
PO : 9	Are able to communicate the results of their work to chemists and non-chemists.
PO : 10	Understand the ethical, historic, philosophical, and environmental dimensions of problems and issues facing chemists.
PO : 11	Find gainful employment in industry or government, be accepted at graduate or professional schools (law, medicine, etc.), or find employment in school systems as instructors or administrators.
PO : 12	Are able to pursue Higher education in Chemistry and other disciplines of inter disciplinary

Course outcomes

Petrochemicals

CO: 1	To gains basic knowledge on Petroleum and petroleum products.
CO: 2	. To explain the market drivers for the refining industry.
CO: 3	To indicate what crude oils consist of and how crude oils are characterized based on their physical properties.
CO: 4	To express the objectives of petroleum refining and classify the processes used in petroleum.
CO: 5	To demonstrate how a petroleum refinery works and sketch a flow diagram that integrates all refining processes and the resulting refinery products
CO: 6	To examine how each refinery process works and how physical and chemical principles are applied to achieve the objectives of each refinery process
CO: 7	To assess implications of changing crude oil feed stocks on refinery configuration and propose strategies to resolve conflicts with degrading crude oil quality and increasingly stringent environmental regulations on petroleum fuels.
CO: 8	To discuss different sources of natural gas and explain how natural gas is processed at well sites and in processing plants with application of selected refinery processes and their physical operations

Specific Program Out comes

Petrochemicals

SEMESTER –I	SPO : 1	Gains knowledge Petroleum reservoirs, their characteristics and mechanisms
	SPO : 2	Understands the types of drillings
	SPO : 3	Gains knowledge on reservoir evaluation
	SPO : 4	Gains knowledge on composition, properties and uses of natural gas and LPG
SEMESTER –II	SPO : 1	Gains knowledge on Petroleum Processing Data and crude oil classification
	SPO : 2	Gains knowledge on crude oil distillation
	SPO : 3	Gains knowledge on different types of cracking processes
	SPO : 4	Gains knowledge on petroleum fractions
SEMESTER –III	SPO : 1	Gains basic knowledge on Unit operations and unit processes
	SPO : 2	Gains knowledge on measuring devices, flow meters and chemical reactors
SEMESTER - IV	SPO : 1	Gains knowledge on conduction, radiation and convection
	SPO : 2	Gains knowledge on evaporation and evaporation process
	SPO : 3	Gains basic knowledge on flow fluids
SEMESTER - V	SPO : 1	Gains basic knowledge about adsorption, absorption and distillation.
	SPO : 2	Gains some basic knowledge about extraction, crystallization and drying.
	SPO : 3	Gains some basic knowledge on purification of gases and natural gas.
	SPO : 4	Gains some basic knowledge about synthesis gas, its applications and synthetic detergents.
SEMESTER - VI	SPO : 1	Gains knowledge and awareness about some applied industrial products of C1, C2, C3 and C4 compounds and petroleum aromatics
	SPO : 2	Gains knowledge about chemicals produced from coal, coke, cellulose plastics and corrosion and prevention in industry.
	SPO : 3	Gains some knowledge about polymers, synthetic rubbers and plastics
	SPO : 4	Gains knowledge on moulding and different types of mouldings

Syllabus for III B.Sc., Petroleum & Petrochemicals

Semester - VI

Paper – VII: **Petrochemicals -II (Elective)**

Unit 1: Chemicals from Methane (C_1 Compounds).

Production of Methanol, Flurochloro methanes, Hydrogen Cyanide and Methylamine from Methane.

Production of Formaldehyde, Tertiary Amyl Methyl Ether (TAME), Dimethyl formamide from Methanol.

Production of Hexamethylene Tetramine and Ethylene Glycol from formaldehyde.

Unit 2: Chemicals from Ethylene (C_2 compounds)

Production of Ethylene by Naphtha cracking – manufacture of vinyl chloride, vinyl Acetate, Ethanol, Acetaldehyde, Ethylene oxide, Ethylene glycols from Ethylene –

Unit 3: Chemicals from propylene (C_3 compounds) Production of Propylene by catalytic cracking of Petroleum distillate - Production of Isopropyl Alcohol, Propylene oxide, Acrylonitrile, Acrolein, Acrylic Acid and Epichlorohydrin from Propylene.

Unit 4: Chemicals from Butylene, Butadiene and pentanes. (C_4 and C_5 compounds)

Dehydrogenation of Butanes for the Production of Butenes and Butadiene – catalytic dehydrogenation of butanes for the production of Butadiene – Production of methacrylic acid, MTBE from Butenes.

Production of Adipic acid from Butadiene – production of Isoprene frommethyl butenes (C_5 feed).

Unit 5- : Petroleum Aromatics and its chemicals:

Production of BTX through catalytic reforming, Reformate separation into Aromatics (Undex process), BTX separation from crude BTX Disproportionation of Toluene into Benzene and Xylenes, Isomerization of Xylenes to p-Xylene.

Chemicals from BTX Aromatics - Styrene from Benzene, Caprolactam and Toluene Diisocyanate from Toluene, Dimethyl Terephthalate from p-xylene.

Suggested Reading:

1) A Text on Petrochemicals by Dr. B.K. Bhaskara Rao Khanna Publishers, Delhi.
2) Petrochemicals process Technology by ID Mall Macmillan India Ltd.,
3) Introduction to Petrochemicals by Sukumar Maiti Oxford IBH.

III B.Sc., Petroleum & Petrochemicals

MODEL QUESTION PAPER

Paper –VII: Petrochemicals – II (ELECTIVE)

Time: $2^1/_2$ Hrs. Semester - VI Max. Marks 60

Section-I

Answer any Three questions.
All questions carry equal marks. 3 x 16 = 48 Marks

1. a. With a neat flow chart, describe the process of manufacturing of methanol from methane.
   b. With a neat flow chart, describe the process of manufacturing formaldehyde from methanol.

2. a. Explain about the production of Ethylene by steam cracking of Naphtha.
   b. With a neat flow diagram describe the process of production of Ethylene Oxide from ethylene.

3. a. with a neat flow chart explain the process of production of Propylene by catalytic cracking of petroleum Distillate.
   b. With a neat flow diagram describe the process of production of Acrylonitrile from Propylene.

4. a. With a neat flow diagram describe the process of catalytic dehydrogenation of Butenes for the production of Butadiene.
   b. Explain the production of MTBE with a neat flow chart.

5. a. With a neat flow chart describe the Udex process for Aromatics Separation from Reformate.
   b. With a neat flow diagram, describe the process of isomerization of Xylenes to p-Xylene.

Section II

Write short notes on ANY FOUR of the following: 4x3=12 Marks

6. Production of Methylamines from Methane.
7. Production of Ethylene glycol from Ethylene.
8. Epichlorohydrin from propylene.
9. Production of Adipic acid from Butadiene.
10. Production of DMT from Paraxylene.

Note to paper setter:
In Section I, one essay questions are to be set from each of the 5 units.
Similarly, in section II, one short answer question is to be set from each of the 5 units.

III B.Sc., - Petroleum & Petrochemicals
Paper –VII: SEMESTER - VI
PETROCHEMICALS – II (Elective)
QUESTION BANK

Essay Questions: 16 M

UNIT –I:

1. a. With a neat flow chart, describe the process of manufacturing of methanol from Methane.
   b. With a neat flow chart, describe the process of manufacturing of HCN from Methane.
2. a. With a neat flow chart, describe the process of manufacturing of formaldehyde from methanol.
   b. With a neat flow chart, describe the process of manufacturing Di methyl Formaldehyde (DMF) from methanol.
3. a. With a neat flow chart, describe the process of manufacturing of Tertiary Amyl Methyl Ether (TAME) from methanol.

b. With a neat flow chart, describe the process of manufacturing Ethylene Glycol from formaldehyde.

UNIT –II:

1. a. Explain about the production of Ethylene by steam cracking of Naphtha.
   b. With a neat flow diagram describe the manufacture of vinyl chloride from ethylene.

2. a. With a neat flow diagram describe the manufacture of vinyl acetate from Ethylene.
   b. With a neat flow diagram describe the manufacture of Ethyl alcohol from Ethylene.

3. a. With a neat flow diagram describe the process of production of Ethylene Oxide from ethylene.
   b. With a neat flow diagram describe the process of production of Acetaldehyde from ethylene.

UNIT –III:

1. a. With a neat flow chart explain the process of production of Propylene by catalytic cracking of petroleum Distillate.
   b. With a neat flow chart explain the process of production of Isopropyl alcohol from propylene.

2. a. With a neat flow chart explain the process of production of Propylene oxide from propylene.
   b. With a neat flow diagram describe the process of production of Acrylonitrile from Propylene.

UNIT –IV:

1. a. With a neat flow diagram describe the process of catalytic dehydrogenation of Butenes for the production of Butadiene.
   b. With a neat flow diagram describe the process of production of methacrylic acid from Isobutylene

2. a. Explain the production of MTBE with a neat flow chart from Isobutene

   b. With a neat flow diagram describe the process of production of Maleic anhydride from C_4 unsaturates.

3. a. With a neat flow diagram describe the process of production of Isoprene from methyl butenes
   b. With a neat flow diagram describe the process of production of adipic acid from Buta diene.

UNIT –V:

1. a. With a neat flow chart describe the Udex process for Aromatics Separation from Reformate.
   b. With a neat flow diagram describe the process of production of BTX aromatics by catalytic reforming of Naphtha
2. a. With a neat flow diagram describe the process of disproportionation of toluene into Benzene and Xylenes.
   b. With a neat flow diagram describe the process of isomerization of xylene to p-xylene.

3. a. With a neat flow diagram describe the process of production of styrene from benzene.
   b. With a neat flow diagram describe the process of production of

Short answer questions: 03 M

UNIT - I:

1. Explain about the production of ethyl amine from methane
2. Write about the production of Fluoro – chloro methane's from methane
3. Write about the production of hexa methylene tetra amine
4. Write about the production of Dimethyl formamide from Methanol.

UNIT - II:

1. Production of Ethylene glycol from Ethylene
2. Production of acetaldehyde from Ethylene

UNIT - III:

1. Production of Epichlorohydrin from propylene
2. Production of Acrolein from propylene

UNIT - IV:

1. Production of Adipic acid from Butadiene.
2. Conversion of Butanes to Butenes
3. Manufacture of Butadiene from Butanes

UNIT - V:

1. Production of DMT from Para xylene.
2. Reformate separation into aromatics
3. Toluene di isocyanate from toluene

IMPORTANT NOTE TO PAPER SETTER:

In section - I, one essay question is to be set from each of the five units. Similarly in

Section - II, one short answer question is to be set from each of the five units. Questions should be given from QUESTION BANK.

III B.Sc., Petroleum & Petrochemicals

Paper –VIII: **Petrochemicals – III (Cluster -I)**

Time: $2^1/_2$ Hrs. **Semester - VI** Max. Marks 60

Unit 1: Petroleum Coke and Carbon Black

Petroleum Coke - methods of production - Delayed coking, fluid coking, contact coking, Manufacture of carbon electrodes.

Carbon Black: Methane decomposition - Wulff's process Manufacture of Carbon Black by Phillips Furnace process - Activated Carbon and its applications.

Unit 2: Coal and its Chemicals:

Formation of coal and its properties carbonization - Low Temperature Carbonization (LTC) and High Temperature Carbonization (ATC) - Processing of Carbonization Products (Coke-oven gas processing), Fractional Distillation of coat Tar, Gasification of coal, Liquefaction of coal.

Synthetic Fuels from Coal - Berzius Process and Fischer Tropsch process.

Unit 3: Cellulose Plastics:

Manufacture of Cellulose Nitrate and Cellulose Acetate - Manufacture of Rayon by Vizcose Process and Cuprammonium Process, Manufacture of Cellulose Acetate Butyrate (Cab), Ethyl Cellulose and Carboxy Methyl Cellulose (CMC).

Unit 4: Miscellaneous Petrochemicals:

a. Resin and Rubber Chemicals - stabilizers, Antioxidants, Accelerators, Plasticizers

b. Pesticides from Petroleum: DDT, BHC, 2, 4-D, Captan, Malathion, Parathion.

c. Organic Dyes: Azo dye, Orange-II, Congo Red, Anthraquinone dye, Indigo, Fluorescein and Malachite green.

d. Explosives: TNT, Tetryl, RDX, HMX, Dynamite, PETN.

e. Petroleum Protein.

Unit 5: Corrosion and Material of construction in Petroleum and petrochemical Industries

Fundamentals of corrosion - classification of Corrosion-Types of Corrosion - Factors affecting corrosion - corrosion in Pipelines.

Corrosion Prevention and control - Selecting Corrosion Resistant Material of Construction - Corrosion Inhibitors - Use of Inhibitors in Petroleum and Petrochemicals Industries - Isolation of material from the Corrosive Atmosphere - coating.

Suggested Reading.

1) A Text on Petrochemicals by Dr. B.K. Bhaskara Rao, Khanna Publishers.
2) Fuels and petrochemical processing by B.K. Sharma Goel Publishing House Meerut.
3) Dryden's Out lines of Chemical Technology by M. Gopala Rao and Marshall sitting East – West Press.
4) Introduction to petrochemicals by Sukumar Maiti Oxford & IBH Publishing Co. Pvt. Ltd.,
5) Outlines of Polymer Technology – Manufacture of Polymers by R. Sinha Prentice Hall of India Private Ltd.

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III B.Sc., Petroleum & Petrochemicals

Paper –VIII: **Petrochemicals – III (Cluster -I)**

Time: $2^1/_2$ Hrs. **Semester - VI** Max. Marks 60

Unit 1: Petroleum Coke and Carbon Black

Petroleum Coke - methods of production - Delayed coking, fluid coking, contact coking, Manufacture of carbon electrodes.

Carbon Black: Methane decomposition - Wulff's process Manufacture of Carbon Black by Phillips Furnace process - Activated Carbon and its applications.

Unit 2: Coal and its Chemicals:

Formation of coal and its properties carbonization - Low Temperature Carbonization (LTC) and High Temperature Carbonization (ATC) - Processing of Carbonization Products (Coke-oven gas processing), Fractional Distillation of coat Tar, Gasification of coal, Liquefaction of coal.

Synthetic Fuels from Coal - Berzius Process and Fischer Tropsch process.

Unit 3: Cellulose Plastics:

Manufacture of Cellulose Nitrate and Cellulose Acetate - Manufacture of Rayon by Vizcose Process and Cuprammonium Process, Manufacture of Cellulose Acetate Butyrate (Cab), Ethyl Cellulose and Carboxy Methyl Cellulose (CMC).

Unit 4: Miscellaneous Petrochemicals:

a. Resin and Rubber Chemicals - stabilizers, Antioxidants, Accelerators, Plasticizers

b. Pesticides from Petroleum: DDT, BHC, 2, 4-D, Captan, Malathion, Parathion.

c. Organic Dyes: Azo dye, Orange-II, Congo Red, Anthraquinone dye, Indigo, Fluorescein and Malachite green.

d. Explosives: TNT, Tetryl, RDX, HMX, Dynamite, PETN.

e. Petroleum Protein.

Unit 5: Corrosion and Material of construction in Petroleum and petrochemical Industries

Fundamentals of corrosion - classification of Corrosion-Types of Corrosion - Factors affecting corrosion - corrosion in Pipelines.

Corrosion Prevention and control - Selecting Corrosion Resistant Material of Construction - Corrosion Inhibitors - Use of Inhibitors in Petroleum and Petrochemicals Industries - Isolation of material from the Corrosive Atmosphere - coating.

Suggested Reading.

1) A Text on Petrochemicals by Dr. B.K. Bhaskara Rao, Khanna Publishers.
2) Fuels and petrochemical processing by B.K. Sharma Goel Publishing House Meerut.
3) Dryden's Out lines of Chemical Technology by M. Gopala Rao and Marshall sitting East – West Press.
4) Introduction to petrochemicals by Sukumar Maiti Oxford & IBH Publishing Co. Pvt. Ltd.,
5) Outlines of Polymer Technology – Manufacture of Polymers by R. Sinha Prentice Hall of India Private Ltd.

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III B.Sc., Petroleum & Petrochemicals

MODEL QUESTION PAPER

Paper - VIII: Petrochemicals – III (Cluster -I)

Time: $2^1/_2$ Hrs. Semester - VI Max. Marks 60

Section-I

Answer any three questions from the following.

All questions carry equal volumes $3 \times 16 = 48$ Marks

1) a) With the help of a flow diagram describe the process of production of coke by Delayed coking Technology.

   b) Describe the process of production of carbon black by Phillips oil furnace process with a neat flow diagram.

2) a) What is carbonization? Describe the High Temperature carbonization process.

   b) With a neat diagram, describe the process of coal gasification.

3) a) With a neat flow chart describe the process of manufacturing Rayon by Viscose Process.

   b) With a neat flow chart describe the process of production of cellulose Acetate Butyrate.

4) a) Describe how Parathion is manufactured with the help of a flow sheet.

   b) Write briefly about classification of explosives. Write briefly about the production of the following explosives.

   (i) TNT (ii) RDX iii) Dynamite

5) a) Write an essay on the corrosion in Petroleum and Petrochemicals Industries.

   b) Write detailed notes on the use of Corrosion Inhibitors in Petroleum and Petrochemical Industries.

Section - II

Write short notes on any FOUR of the following $4 \times 3 = 12$ Marks

6) Manufacture of Carbon Electrodes

7) Berzius Process

8) Cellulose Nitrate

9) Petroleum Protein

10) External Pipeline Corrosion.

Note to paper setter:
In Section I one essay question is to be set from each of the Five (5) units.
Similarly in Section II one short answer question is to be set from each of the Five (5) units.

III B.Sc., - Petroleum & Petrochemicals

SEMESTER - VI

Paper – VIII: PETROCHEMICALS – III (CLUSTER - 1)

QUESTION BANK

Essay Questions: 16 M

Unit – I:

1. a. With a neat flow diagram describe the manufacturing method of Petroleum coke by delayed coking unit.
   b. With a neat flow diagram describe the process of production of petroleum coke by fluid coking method.
2. a. With the help of a flow diagram describe the process of production of petroleum coke by continuous contact coking
   b. With a neat flow diagram describe the process of production of carbon black by Philips furnace process.

Unit – II:

1. a. What is Carbonization? Describe the process of low temperature carbonization
   b. With a neat flow diagram describe the processing of gasification of coal
2. a. What is Carbonization? Describe the process of high temperature carbonization
   b. With a neat flow diagram explain the products that can be obtained by fractional distillation of coal tar

Unit – III:

1. a. With a neat flow diagram describe the conventional process of manufacturing of cellulose acetate
   b. With a neat flow chart describe the process of manufacturing of Rayon by viscose process
2. a. With a neat flow diagram describe the manufacturing process of Rayon by Cuprammonium process
   b. With a neat flow diagram describe the manufacturing process of cellulose acetate butyrate
3. a. With a neat flow diagram describe the process of manufacturing of cellulose nitrate
   b. With a neat flow diagram describe the process of manufacturing of Carboxy methyl cellulose

Unit – IV:

1. a. With a neat flow diagram describe the manufacturing process of DDT
   b. With a neat flow diagram describe the manufacturing process of 2,4 - D
2. a. With a neat flow diagram describe the manufacturing process of Parathion
   b. Describe the manufacturing process of production of important dyes

3. a. Write briefly about the production of the following explosives.

   i. TNT (ii) RDX iii) Dynamite

   b. Write in detail about petroleum protein

Unit – V:

1. a. Write an essay on various types of corrosion
   b. Write in detail about corrosion in petroleum and petrochemicals
2. a. Write an essay on corrosion in pipe lines
   b. Write detailed note on isolation of material from the corrosive atmosphere

Short answer questions: 03 M

Unit – I:

1. Manufacture of carbon electrodes
2. Manufacture of carbon black by methane decomposition
3. Wulfs process for the production of carbon black
4. Applications of activated carbon

Unit – II:

1. Different grades of coal
2. Calorific value
3. Liquefaction of coal
4. Berzius process
5. Fischer tropsch process

Unit – III:

1. Sources and structure of Cellulose
2. Manufacturing process of Ethyl Cellulose
3. Manufacturing of Carboxy methyl cellulose

Unit – IV:

1. Manufacturing process for BHC
2. Manufacturing process for Malathion
3. Manufacturing of captain
4. Preparation of TNT and Dynamite

Unit – V:

1. Classification of corrosion
2. Factors affecting corrosion
3. Corrosion inhibitors.

IMPORTANT NOTE TO PAPER SETTER:

In section - I, one essay question is to be set from each of the five units. Similarly in

Section - II, one short answer question is to be set from each of the five units. Questions should be given from QUESTION BANK.

III B.Sc., - Petroleum & Petrochemicals

Semester - VI

Paper –IX: **Manufacturing Processes of Polymers & Flow of fluids** (Cluster -II)

Unit – 1: Flow of fluids - I:
Nature of Fluids – Hydrostatic pressure, Manometers – U-tube, Differential and inclined – Viscosity, Newton's Law of Viscosity Types of fluid motion, Mass balance, Equation of Continuity, Energy Balance Bernoulli's Equation, Reynolds's Experiment.

Unit – 2: Flow of fluids - II:
Friction losses in Laminar flow through a circular Tube, Hagen – Poiseuille
Equation, Friction losses in turbulent flow – Fanning equation, Pressure drop in flow through porous media – Fluidization, Cavitation, Water Hammer

Unit – 3: Manufacture of Polycarbonate polymers
Nylons: Manufacture of Nylon – 6, Nylon – 6, 6, Nylon -7
Acrylic Fibers: Production of Poly acrylo Nitrile, & Poly methyl methacrylate (PMMA)
Synthetic Rubbers:
Manufacture of Styrene – Butadiene Rubber, Acrylonitrile – Butadiene Rubber (Nitrile Rubber), Butyl Rubber, Manufacture of Urethane

Unit – 4: Rubber, silicone rubber, polysulphide rubbers.

Unit – 5: Plastics:
Engineering plastics – Phenol – Formaldehyde resins, Production of Novolac and Resol resins, manufacture of Urea – Formaldehyde and Melamine – Formaldehyde Resins, Epoxy – resins and ABS Plastics.

Suggested Reading.

1) A Text on Petrochemicals by Dr. B.K. Bhaskara Rao, Khanna Publishers.
2) Petrochemical process Technology by I.D. Mall Macmillan India Ltd...,
3) Dryden's Out lines of Chemical Technology by M. Gopala Rao and Marshall sitting East – West Press.
4) Introduction to petrochemicals by Sukumar Maiti Oxford & IBH Publishing Co. Pvt. Ltd.,
5) Outlines of Polymer Technology – Manufacture of Polymers by R. Sinha Prentice Hall of India Private Ltd.

III B.Sc., Petroleum & Petrochemicals

MODEL QUESTION PAPER

Paper IX –Manufacturing Processes of Polymers Flow of fluids

Time: $2\frac{1}{2}$ Hrs. Semester -VI Max. Marks 60

Section - I

Answer any Three questions from the following
All questions carry equal marks. 3x16=48 Marks

1. a. What is Viscosity? How fluids are classified on the basis of Viscosity? Discuss in detail with examples
   b. Derive Bernoulli's Equation

2. a. Derive Hagen – Poiseuille equation.
   b. Write briefly about pressure drop in flow through a porous media

3. a. With a neat flow diagram describe how polyester ribbon is produced from Terephthalic Acid.
   b. With a neat flow diagram describe the process of Production of Nylon-6.

4. a. With a neat flow diagram describe the process of Production of Nitrile Rubber.
   b. With a neat flow diagram describe the process of Production of silicone oils via direct monomer process.

5) a. With a neat flow diagram describe the process of Production of Resol Resin.
   b. With a neat flow diagram describe the process of Production of ABS plastics.

Section – II

Write short notes on ANY FOUR of the following. 4x3=12 Marks

6. Newton's law of viscosity
7. Water Hammer
8. Enant Fibres
9. Poly Sulphide Rubber.
10. U-F Resins

Note to proper setter:
In section I, one essay question is to be set from each of the 5 units. Similarly in section II, one short Answer question is to be set from each of the 5 units.

1. a. What is Viscosity? How fluids are classified on the basis of Viscosity? Discuss in detail with examples
   b. Derive the basic equation for obtaining the pressure at any height in hydrostatic equilibrium and apply it to an incompressible fluid.

2. a. Explain about the design and working of U–tube manometer.
   b. Derive the expression used to calculate the pressure difference in the casea flowing fluid.
   Based on the law of conservation of mass, derive the equation of continuity of one dimensional flow.

Unit-II:

1. Derive Hagen – Poiseuille equation for Friction losses in Laminar flow through a circular Tube
   c. Write in detail about the pressure drop in flow through porous media

2. a. Derive Fanning equation for the Friction losses in turbulent flow
   b. Derive the expression for the relation between friction factor (f) and number (N)

Unit-III

1. a. With a neat flow diagram describe the manufacturing of polyethylene terephthalate from terephthalic acid
   b. With a neat flow diagram describe the manufacturing of polyester filaments from dimethyl terephthalic
2. a. With a neat flow diagram describe the manufacturing of poly carbonate polymer
   b. With a neat flow diagram describe the manufacturing of Nylon -6,6

Unit -IV:

1. a. With a neat flow diagram describe about the production of polystyrene butadiene rubber
   b. With a neat flow diagram describe the manufacturing of acrylonitrile butadiene rubber
2. a. With a neat flow diagram describe the manufacturing of butyl rubber
   b. With a neat flow diagram describe the manufacturing of silicone polymers by Grignard process

Unit -V:

1. a. With a neat flow diagram describe the manufacturing of Novolac resins
   b. With a neat flow diagram describe the manufacturing of Urea formaldehyde resins
2. a. With a neat flow diagram describe the manufacturing process of melamine formaldehyde resins
   b. With a neat flow diagram describe the manufacturing process of Epoxy resins

Short answer Questions: 03 M

Unit – I

1. Write about Newton's law of viscosity
2. Explain briefly about Newtonian and non-Newtonian fluids.
3. Write about Reynolds number

Unit – II

1. Explain briefly about Water Hammer
2. Write about Fluidization
3. Write about Cavitation

Unit – III

1. Saturated and unsaturated polyesters
2. Nylon -6
3. Nylon-7
4. Poly acrylic nitrile

Unit – IV

1. Vulcanization process
2. Urethane rubber
3. Poly sulphide rubbers

Unit - V

1. ABS plastics
2. Resol resins
3. Preparation of melamine

IMPORTANT NOTE TO PAPER SETTER:

In section - I, one essay question is to be set from each of the five units. Similarly in

Section - II, one short answer question is to be set from each of the five units. Questions should be given from QUESTION BANK.

III B.Sc., - (Petroleum & Petrochemicals)

Semester - VI

Paper –X: **Testing and processing Techniques of Polymers** (Cluster - III)

Unit – 1: Testing of Polymers: -

Plastics and their appearance – Preliminary Tests, Solubility and Density, Behaviour on Heating, Glass Transition Temperature and its determination,

Testing for Heteroatoms – Lassaigne method, Formaldehyde test. General Identification Reactions: Libermann – Storch – morawski Reaction, Colour reaction with p-dimethyl amino benzaldehyde, Gibbs Indophenol test, Formaldehyde test.

Specific Identification Tests for the following Polymers – Polyolefins, Polystyrene, Polyamides, Polyesters, Resins.

Unit – 2: Extrusion Moulding:

Different elements and functions of a typical Extruder Screw, Screw zones and Screen Packs, Flat – film extruder, Sheet Extruder – problems of extruding ..

Unit – 3: Compression Moulding:

Types of Compression Moulds – Flash, Semi positive, Positive and Landed Positive – Down Stroking Compression Molding process – Side Ram type compression Moulding process and rotary press - cold moulding - Cooling Fixtures and shrink blocks.

Unit – 4: Transfer Moulding:

Transfer Moulding and its functioning – Equipment required for Transfer Moulding process – Plunger type Transfer Mould – Screw Transfer Mould assemblies – Runners, Gates and vents – Role of pressure in a Transfer Moulding system -.

Unit – 5: Blow Moulding, and finishing operations:

Blow Moulding – Blow – die forming, Injection Blow Moulding, Continuous Extrusion Blow Moulding, Inter militant extrusion Blow Moudling.

Finishing Operations: Filing, Scraping, Tumbling, Grinding and Sanding, Ashing and Buffing – Polishing of Polymeric Material.

Suggested Reading:

1) Simple Methods of Identification of Plastics – by Dietrich Braun.
Carl Hanser Verlog Munich – Germany.

2) Outlines of Polymer Technology.
Processing polymers by R. Sinha, Prentice Hall of India Pvt. Ltd., New Delhi

III B.Sc., - (Petroleum & Petrochemicals)

Semester - VI

Paper –X: **Testing and processing Techniques of Polymers** (Cluster - III)

Unit – 1: Testing of Polymers: -

Plastics and their appearance – Preliminary Tests, Solubility and Density, Behaviour on Heating, Glass Transition Temperature and its determination,

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2) Outlines of Polymer Technology.

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III B.Sc., Petroleum & Petrochemicals

MODEL QUESTION PAPER

Paper –X: Testing and Processing Techniques of Polymers (Cluster III)

Time: 2 $^{1}/_{2}$ Hrs. Semester - VI Max. Marks 60

Section - I

Answer any Three questions from the following
All questions carry equal marks. 3x16=48 Marks

1. a. What are thermosets and thermoplasts?
   Write briefly about solubility tests for some important polymers.

   b. Write specific Identification tests for the following plastics.
   i) Polyolefins ii) Polyamides

2. a. Define extrusion. Write short notes on.
   i) screw zones ii) Screen packs

   b. With the help of neat sketch, describe the working of flat film extruder.

3. a. Explain the significance of the following two types of compression moulds.
   i) Positive type mould ii) Landed positive type mould

   b. With the help of a neat sketch, discuss the side-ram type of compression moulding process.

4. a. Define Transfer moulding.
   With a neat sketch, describe the plunger type transfer mould technique.
   b. With the help of a neat sketch, explain the working of a typical screw transfer moulding press.

5. a. With a neat sketch describe the technique of Intermittent extrusion blow moulding.
   b. Write in briefly about some of the important finishing operations.

Section II

Write short notes on ANY FIVE of the following. 5x2=10 Marks

6. Gibbs Indophenol Test
7. Explain problems of extruding
8. What is cold moulding? Give examples.
9. Explain briefly about the Runners and Gates that are used in Transfer moulding.
10. Write short notes on blow die forming

Note to paper setter:
In section I, one essay question is to be set from each of the 5 units.
Similarly, in question II, one short answer question is to be set from each of the 5 units.

III B.Sc., - (Petroleum & Petrochemicals)

Semester - VI

Paper –X: **Testing and processing Techniques of Polymers** (Cluster - III)

QUESTION BANK

Essay Questions: 16 M

Unit – I:

1. a. Write an essay on the analysis procedure of plastics
   b. Explain about the experimental determination of glass transition temperature

2. a. Write about the experimental details of testing of hetero atoms present in plastics
   b. Write in detail about the following,
   i. Liebermann - storch-morawski reaction
   ii. Color reaction with p- dimethyl amino benzaldehyde
   iii. The Gibbs indophenol test

Unit -II:

1. a. With a neat sketch explain about the different elements and their functions of typical extruder
   b. With a neat sketch describe the working of a flat film extruder using a quench tank
2. a. With a neat sketch describe the working of a flat film extruder using a chilling roll
   b. Describe the manufacturing process of polymer sheets and how they are different from polymer films?

Unit -III:

1. a. Describe in detail about the flash type of compression moulding technique
   b. With a neat sketch describe about the semi positive compression moulding technique
2. a. Explain about the design details of the mould and also explain the significance of positive type compression mould and Landed positive type compression mould
   b. With a neat sketch explain about the complete cycle of operation of a down stroking compression moulding press.

Unit -IV:

1. a. With a neat sketch explain about the commercially used true transfer moulding
   b. With a neat sketch describe about the plunger type transfer moulding
2. a. With a neat sketch explain in detail about the screw transfer moulding process
   b. Explain in detail about the different types of pressures in a transfer moulding system

Unit -V:

1. a. With the neat sketches explain about the techniques of continuous extrusion blow moulding
   b. With the neat sketches explain about the techniques of intermittent extrusion blow moulding

2. a. With a neat sketch explain about the following,
   i. Blow die forming of thermoplastic sheets
   ii. Blow moulding a hollow sphere with sheets
   iii. Blow moulding with softened tubular thermoplastic
   b. With a neat sketch explain about the injection blow moulding

Short answer Questions: 03 M

Unit – I:

1. Types of Plastics
2. Solubility of plastics
3. Formaldehyde test
4. Specific identification tests for poly olefins and poly styrene
5. Poly amides and poly esters

Unit – II:

1. Screw with a disrupter
2. Screw Zones
3. Screen packs
4. Die swell

Unit – III:

1. Cooling fixtures
2. Shrink blocks
3. Cold moulding
4. Compression moulding with rotary press

Unit – IV:

1. Runners in a transfer mould
2. Gates in a transfer mould
3. Vents in a transfer mould
4. Equipment required for a transfer moulding process

Unit – V:

1. Polishing of polymer material
2. Tumbling
3. Grinding and sanding
4. Ashing and Buffing.

IMPORTANT NOTE TO PAPER SETTER:

In section - I, one essay question is to be set from each of the five units. Similarly in Section - II, one short answer question is to be set from each of the five units. Questions should be given from QUESTION BANK.

III B.Sc., - (Petroleum & Petrochemicals)

Practical Syllabus

Semester - VI

PRACTICAL – VII : (At the end of Sixth Semester)

1) Preparation of Fluorescein Dye.
2) Preparation of Azo Dye.
3) Preparation of Novolac resin.
4) Preparation of Resol Resin.

PRACTICAL VIII (At the End of Sixth Semester)

1) Preparation of Urea – Formaldehyde resin.
2) Preparation of Cold Cream.
3) Preparation of Terephthalic Acid.
4) Preparation of Dimethyl Terephthalate.

PRACTICAL IX (At the end of sixth semester)

1) Adsorption of Oxalic Acid on Silica gel – Study of validity of Freundlisch Adsorption Isotherm.
2) Determination of viscosity of polymer solutions by using Ostwald viscometer.
3) Sedimentation
4) Determination of Heat of Solution

SCHEME OF VALUATION

Max. Marks: 50

1)	Procedure to be written in the first 15 minutes	10 Marks
2)	Recording of data and reporting the value	20 Marks
	upto 2% error	
	Error up to 5%	10 Marks
	Error greater than 5%	5 Marks
3)	Viva – Voice	10 Marks
4)	Record	10 Marks

III B.SC., Petroleum & Petrochemicals

Project work.

Marks: 50

(At the end of 6th Semester)

Project work	...	40	Marks
VIVA	...	10	Marks
Total	...	50	Marks