FACULTY OF SCIENCE

SYLLABI

FOR
INDUSTRIAL CHEMISTRY
Elective (Semester system)
EXAMINATIONS 2016-2017
PANJAB UNIVERSITY, CHANDIGARH

Outlines of tests, syllabi and course of reading for B.Sc. (Semester system) examinations in the Elective of “Industrial Chemistry” 2016-2017

OBJECTIVE OF THE COURSE

To teach the fundamental concepts of Industrial Chemistry and their applications. The syllabus pertaining to B.Sc. (Semester system) in the subject of Chemistry has been upgraded as per provision of the UGC module and demand of the academic environment. The course contents have been revised from time to time as per suggestions of the teachers of the Chemistry working in the Panjab University, Chandigarh. The syllabus contents are duly arranged unit wise and contents are included in such a manner so that due importance is given to requisite intellectual and laboratory skills.

Subject Title: “Industrial Chemistry (Elective)”.

B.Sc. (General) Semester-I:

Paper A: Core 111, 112, & 113 i.e. Industrial Aspects of Organic, Inorganic and Physical Chemistry. 75

Paper B: Core 124, 125 and 126 i.e. Material and Energy balance; Unit operations in Chemical Industry; utilities & fluid flow and Heat transport. 75

Practicals: Total combined practical mentioned under B.Sc.Ist year (Semester I and II) 50

NOTE: The Entrepreneurship Development Course will be taught in the 3rd and 4th semester programme of B.A./B.Sc. This course being a non-credit course, the examination will be conducted by the Colleges themselves as they do for the House Examination. The result is to be conveyed in a sealed cover to be Deputy Registrar (Secrecy) P.U., Chandigarh well before the commencement of the final Examination.
### SUBJECT: INDUSTRIAL CHEMISTRY
**ACADEMIC PROGRAMME: B.Sc. Ist Semester & 2nd Semester**

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**Core**  
**Semester II**

| 124     | Material and Energy Balance               | 1                 |            |                        |
| 125     | Unit Operations in Chemicals Industry    | 1                 | 3          | 6                      |
| 126     | Utilities and Fluid Flow and Heat Transport | 1                 |            |                        |

**JOB POTENTIAL OF VOCATIONAL PROGRAMME IN INDUSTRIAL CHEMISTRY**

The graduates with Industrial Chemistry are better suited for the job requirements in an industrial environment. As the course covers almost all the aspects of a chemicals industry, these students will be suitable for any Department in Chemical industry, like production Q.C., product development effluent treatment etc. They will be better motivated and chances of going up in the organization will be much higher. The suggested course is for the most part, general in nature and they could be absorbed in any Chemical Industry. The students will be able to start or be employed in village industries based in agricultural raw materials or agro based industries such as insecticides. They will also be suitable in Technical Marketing of product. They can be employed by the Government in Factory Inspectorate, Pollution Control agencies and other development agencies. There is scope for them to be employed in Banks, Financial Institutions etc., where their experience may be utilized in Project Appraisals for purposes of financing projects. Thus, a graduate in Industrial Chemistry will be a better motivated and more useful person in the Chemical Industries and allied Government and non-Governmental bodies. It is anticipated that there will be very good demand for these graduates.
NOTE ON SYLLABUS FOR INDUSTRIAL CHEMISTRY AT
B.Sc. LEVEL

The practicals in Industrial Chemistry B.Sc. course can be conducted in the present Chemistry undergraduate laboratories. At present, generally 40/60 students work in the laboratory and they are divided into two/three batches of 20 students each. The same strength may be maintained for the Ind. Chem. course. The normal agents, chemicals and lab-wares provided to the Chemistry students are sufficient for Ind. Chem. students. Additional minor equipments required are given below semester wise. No costly sophisticated equipments are required for the entire course.

Paper A - No, additional equipments required.

Paper B - Refractometer, Tensiometer/stalgmometer, Polarimeter, Viscometer (Ostwald).

Demonstration Experiments: Different types of valves, fittings, Laboratory models of filters, dryers, impeller

B.Sc. Semester-I

Paper A

Industrial Aspects of Chemistry

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Unit I

8L

Fractionation of crude oil, cracking, reforming, hydroforming, isomerisation.
Coal: Types, structure, properties, distillation of Coal, Advantages and disadvantages of coal.

Unit II

7L

Cellulose; Viscose manufacturing and Cellulose acetate manufacturing, Manufacture of starch, dextrin and dextrose from corn, Alcohol and alcohol based chemicals oxalic acid, furfural
Basic metallurgical operations- Pulverisations, Calcinations, Roasting, Refining

Unit III

7L

Physicochemical principles of extraction of –Iron, Lead
Silver, Sodium, Aluminum.
Inorganic materials of industrial importance-Their availability, forms, structure and modification.
Alumina, silicates and types, zeolites.

Unit IV

8L

Surface chemistry and Interfacial phenomena, Adsorption isotherm, Sols, Gels, Emulsions. Microemulsions, Micelles, Aerosols, Effect of surfactants
Catalysis: Introduction, Types-Homogeneous and Heterogeneous, Catalytic poisoning, Autocatalysis, Negative catalysis.
Introduction to phase transfer catalysis.
Suggested Books


Instructions for paper setters and candidates:

I. Examiner will set total of NINE questions comprising TWO questions from each unit and ONE compulsory question of short answer type covering whole syllabi.

II. The students are required to attempt FIVE questions in all, ONE question from each unit and the Compulsory question.

III. All questions carry equal marks.
**B.Sc. Semester-II**  
**PAPER B**

**Material and Energy Balance**

**OBJECTIVE OF THE COURSE**

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**UNIT I**

**Dimensions and units:** Basic Chemical Calculations-Atomic weight, molecular weight, equivalent weight, mole, mole fractions

**Material balance**

The concept of material Balance, Open and closed systems, Steady state and Unsteady state systems, Multiple component systems, Accounting for Chemical Reactions in material balances, Material balance for batch and semi batch process Concept of limiting reactant conversion, yield. (Qualitative treatment only).

**UNIT II**

**Energy Balance** Heat capacity of pure gases and gaseous mixtures at constant pressures. Sensible heat changes in liquids, enthalpy changes. (Qualitative treatment only).

**Distillation** Introduction, Batch and continuous distillation, Separation of azeotropes, Plate columns and packed columns

**Absorption** Introduction: Equipments- packed columns, spray Columns, bubble columns, packed bubble columns, mechanically agitated contractors.

**UNIT III**

**Evaporation** Introduction, Equipments- short tube (standard) Evaporator, forced circulation evaporators, falling film evaporators, climbing film (upward flow) evaporators, wiped (agitated) film evaporator

**Filtration** Introduction, filter media and filter aids, equipments- plate and frame filter press, nutsch filter, rotary drum filter, sparkler filter, candle filter, bag filter, centrifuge.

**Drying** Introduction, free moisture, equipments- tray dryer, rotary dryer, flash dryer, fluidized. bed dryer, drum dryer, spray dryer.

**Extraction** Introduction: selection of solvent
UNIT IV

**Fuel**- types of fuels- advantages and disadvantages of combustion of fuels, calorific value, specifications for fuel oil.

**Boilers**- types of boilers and their functioning.

**Water**- specifications for industrial use, various water treatments, desalination

**Air**- specifications for industrial use, Processing of air.

**Heat Transfer**: Heat exchangers- shell and Tube type; finned tube heat exchangers, plate heat exchangers.

**Suggested Books**


**Instructions for paper setters and candidates:**

I. Examiner will set total of **NINE** questions comprising **TWO** questions from each unit and **ONE** compulsory question of short answer type covering whole syllabi.

II. The students are required to attempt **FIVE** questions in all, **ONE** question from each unit and the Compulsory question.

III. All questions carry equal marks.

IV. Complex numerical problems not to be asked
Simple techniques used in Chemistry lab

1. Calibration of thermometers
2. Fractional Crystallization (Copper Sulphate-Mohr Salt Solution)
3. Distillation: Simple, Vacuum, Fractional, Distillation (1 Expt. Each)
4. Filtration: Simple Filtration, Vacuum Filtration
5. Preparation of Standard solutions of NaOH, KMnO4, H2SO4, HCl, Oxalic Acid, Na2CO3 with introduction to primary and secondary standards.
6. Determination of sulphuric acid and phosphoric acid in a mixture.
7. Determination of Elevation and depression in b.p/m.p of liquids. Determination of Vant Hoff Factor, Degree of Dissociation in strong electrolyte.

Applications of Refractometer, Polarimeter, Stalagamometer, Viscometer.

8. Determine the Refractive Index and polarizability of a given liquid using a refractometer.
9. Determine the concentration of sugar in a solution refractometrically
10. Determine specific rotation of a given compound.
11. Determine the percentages of two active substances in a solution with polarimeter.
12. Identify whether the given compound is dextro-rotatory or laevo rotatory.
13. Compare cleansing power of detergents (any two) with stalagamometer.
14. To measure the interfacial tension.
15. Determine molar mass of polymers by viscosity method
16. Study the variation of viscosity of ethanol-water with change in composition
   Phase Diagram, Chromatography and Ore analysis
17. Construct a Phase Diagram: Water, Chloroform and Acetic Acid ternary system
18. Application of Thin layer chromatography

Instructions for paper setters and candidates:

General Instructions to the Examiners:
Note: Practical examination will be of four hours duration & shall consist of the following questions:

Q. No. I Expt 1-7 (Perform 1 expt out of two offered) 12 marks
Q. No. II Expt 8-14 (Perform 1 expt out of two offered) 12 marks
Q. No. III Expt 15-18 (Perform 1 expt out of two offered) 12 marks
Q. No. IV Viva-Voce 8 marks
Q. No. V Note Book 6 marks
TRAINING/WORKSHOP/INDUSTRIAL VISITS

i. Visit to a local industry during the year and students to submit a report on the same. The report should contain information about: Raw materials used in industry, Steps involved in manufacturing, Finished product and quality control measures involved.

ii. A demonstration be given to students regarding use of excel for managing data and making graphs.

iii. Demonstration on use of software likes ISIS Draw, Chem Draw or related software available free on the internet.

iv. Each student to deliver a seminar/power point presentation relevant to theory/practical syllabus.

Suggested Books

OBJECTIVE OF THE COURSE

To teach the fundamental concepts of Industrial Chemistry and their applications. The syllabus pertaining to B.Sc. (Semester system) in the subject of Chemistry has been upgraded as per provision of the UGC module and demand of the academic environment. The course contents have been revised from time to time as per suggestions of the teachers of the Chemistry working in the Panjab University, Chandigarh. The syllabus contents are duly arranged unit wise and contents are included in such a manner so that due importance is given to requisite intellectual and laboratory skills.

Subject Title: “Industrial Chemistry (Elective)”.

B.Sc. (General) Semester-III:  
Max. Marks.

Paper A: Core 231, 232 & 233 i.e. Material balance and Unit processes in Org. Chem. Manufacture I & II.  
75

B.Sc. (General) Semester-IV

Paper B: Core 244, 245 & 246 i.e. Pollution, Effluent Treatment and Waste management and Process Instrumentation.  
75

Practicals: Total combined practicals mentioned under B.Sc. II year (Semester III and IV)  
The Entrepreneurship Development course. Non-credit  
50

NOTE: The Entrepreneurship Development Course will be taught in the 3rd and 4th semester programme of B.A./B.Sc. This course being a non-credit course, the examination will be conducted by the Colleges themselves as they do for the House Examination. The result is to be conveyed in a sealed cover to be Deputy Registrar (Secrecy) P.U., Chandigarh well before the commencement of the final Examination.
Material science

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Unit-I
Mechanical properties of materials and change with respect to temperature; Elasticity, Electrical and Thermal conductivity.

Materials of constructions used in Industry
Metals and alloys- Purpose of making alloys, Alloy Steels: Heat resistant, Corrosion resistant, magnetic stainless steels, High speed steels, Brass, Bronze, super alloys,
Cement-Types of cement, composition, manufacturing process, setting of cement.
Ceramics-Introduction, types, properties, manufacturing processes, applications.
Polymeric materials: Constituents of plastic, initiators, inhibitors, Moulding of plastics into articles, Spinning of fibres, mercerization.

UNIT II
Nitration: Introduction-Nitrating agents, Kinetic and mechanism of nitration processes such as nitration of: Paraffinic hydrocarbons, Benzene to nitrobenzene and m-dinitrobenzene
Acetanilide to p-nitroaoacetanilide, Continuous vs batch nitration.

Commercial manufactures- chlorobenzenes, chloromethanes, Mono Chloroacetic acid

UNIT III
Oxidation: Introduction- Oxidizing agents, Kinetics and mechanism of oxidation of organic compounds Liquid phase oxidation, Vapour phase oxidation Commercial manufacture of benzoic acid, maleic anhydride, phthalic anhydride,
Esterification: Commercial manufacture of-ethyl acetate, cellulose acetate.
Hydrolysis: Introduction, hydrolyzing agents, mechanism of hydrolysis

Alkylation: Introduction-Types of alkylation, Alkylating agents Manufacture of-alkylbenzenes (for detergent manufacture); ethylbenzene, phenyl ethyl alcohol, N-alkyl anilines (mono ethyl anilines).

Amination: Methods of reduction-iron and acid reductions, other metal and acid reductions: zinc, tin, electrolytic reductions, metal and alkali reductions, commercial manufacture of aniline, p-amino phenol.

Suggested Books


Instructions for paper setters and candidates:

I. Examiner will set total of NINE questions comprising TWO questions from each unit and ONE compulsory question of short answer type covering whole syllabi.

II. The students are required to attempt FIVE questions in all, ONE question from each unit and the Compulsory question.

III. All questions carry equal marks.
OBJECTIVE OF THE COURSE

To teach the fundamental concepts of Industrial Chemistry and their applications. The syllabus pertaining to B.Sc. (Semester system) in the subject of Chemistry has been upgraded as per provision of the UGC module and demand of the academic environment. The course contents have been revised from time to time as per suggestions of the teachers of the Chemistry working in the Panjab University, Chandigarh. The syllabus contents are duly arranged unit wise and contents are included in such a manner so that due importance is given to requisite intellectual and laboratory skills.

UNIT I
Air, Oxygen, nitrogen cycle, water 8L
Biosphere flora and fauna energy soil.

Pollutants and their statutory limits.
Pollution evaluation methods.

Air pollution-Various pollutants.
Water pollution-Organic/inorganic pollutants.
Sewage analysis, Sludge Treatment
Pesticide pollution

UNIT II
Principles and equipments for aerobic, anaerobic 7L
Treatment, adsorption, filtration, sedimentation.
Bag filters, electrostatic precipitator mist eliminators wet scrubbers
Absorbers

UNIT III
Solid waste disposal and management, 8L
concept of measurement and accuracy
Instrumental Techniques of Environmental Chemical Analysis:
HPLC, GC, Atomic Absorption spectrophotometer, Ion Chromatography

UNIT IV
Temperature- glass thermometers bimetallic 7L
Thermometer pressure spring thermometer, vapour filled
Thermometer, resistance thermometers.
Pressure- Manometers, barometers bourdon
Pressure gauge bellow type, diaphragm type pressure gauges
macleod gauges, Pirani gauges etc.
Liquid level: Direct- indirect liquid level
Density measurement and viscosity measurement
Suggested Books


Instructions for paper setters and candidates:

I. Examiner will set total of NINE questions comprising TWO questions from each unit and ONE compulsory question of short answer type covering whole syllabi.

II. The students are required to attempt FIVE questions in all, ONE question from each unit and the Compulsory question.

III. All questions carry equal marks.
Practicals (A and B)

I. Unit process:
   Nitration: Nitration of benzene/acetanilide
   Sulphonation; To prepare sulphanilic acid from aniline
   Friedel-crafts reactions; To prepare acetophenone/toluene from benzene
   Esterification: Conversion of acetic acid into ethyl acetate
   Hydrolysis: To prepare p-nitroaniline from p-nitroacetanilide
   Polymerization: Preparation of Nylon 6,6 etc. (any One)

II Instrumental methods of analysis-

Use of colorimeter:
   1. Verify beer’s law for KMnO$_4$ and K$_2$Cr$_2$O$_7$ solution and measure concentration of given solution of unknown concentration
   2. Determine iron in a sample of water colorimetrically

pH meter,
   1. Find the normality and strength of a given NaOH solution by titrating against Standard HCl using a pH Meter
   2. Titrate Phosphoric acid and NaOH using pHmetry

Potentiometer,
   1. Titrate HCl and NaOH Potentiometrically
   2. Determine dissociation constant of acetic acid using potentiometer

Conductometer,
   1. To verify Debye-huckel onsager equation.
   2. Study the variation of conductance with dilution in case of strong and weak electrolytes.
   3. Verify Kohlrauch Law. e.g. Find Molar Conductance of Acetic acid at infinite dilution

Polarimeter.

Flash Point Apparatus
   1. Determine the flash point and fire point of oils

Material testing:
   1. Testing of alloys: Any one out of brass/bronze/nickel coin/silver coin/solder
   2. Identification of plastics/rubber Estimation of yield point young’s modulus,
   3. Optical thermal mechanical and electrical properties.
   4. Use of Transducers for measuring flow control.
   5. Water analysis-solid content, Hardness, COD and other tests as per industrial specifications.
   7. Monographs of representative raw materials such as sulphuric acid, sodium carbonate, sodium hyroxide,
   8. Limit tests for heavy metals Pb. As, Hg, Fe and ash content.

Instructions for paper setters and candidates:

General Instructions to the Examiners:

Note: Practical examination will be of four hours duration & shall consist of the following questions:

Q. No. I Unit Process (Perfrom 1 expt out of two offered) 12 marks
Q. No. II Instrumental methods of analysis((Perfrom 1 expt out of two offered) 12 marks
Q. No. III Material testing ((Perfrom 1 expt out of two offered) 12 marks
Q. No. IV Viva-Voce 8 marks
Q. No. V Note Book 6marks
TRAINING/WORKSHOP/INDUSTRIAL VISITS (8 Credits)

i. Visit to a local industry during the year and students to submit a report on the same. The report should contain information about: Raw materials used in industry, Steps involved in manufacturing, Finished product and quality control measures involved. (Different from the one submitted in 1st Year)

ii. A demonstration be given to students regarding use of excel for managing data and making graphs.

iii. Submission of worksheets based on Internet Software like ISIS Draw, Chem Draw and Use of 3D Software like MDL Chime, Cosmo Player etc.

iv. Students will also submit a project report on water-effluent analysis/soil analysis/ food adulteration etc. (Different from the one submitted in first year)

v. Student to submit a report on one small scale unit: Safety matches, Naphtalene balls, Wax candles, Shoe Polish, Gum Paste, Pen Ink, Chalk, Plaster of paris

vi. Each Student to present a seminar relevant to the syllabus.
PANJAB UNIVERSITY, CHANDIGARH

Outlines of tests, syllabi and course of reading for B.Sc. (Semester system) examinations in the Elective of “**Industrial Chemistry**” 2015-2016

**OBJECTIVE OF THE COURSE**

To teach the fundamental concepts of Industrial Chemistry and their applications. The syllabus pertaining to B.Sc. (Semester system) in the subject of Chemistry has been upgraded as per provision of the UGC module and demand of the academic environment. The course contents have been revised from time to time as per suggestions of the teachers of the Chemistry working in the Panjab University, Chandigarh. The syllabus contents are duly arranged unit wise and contents are included in such a manner so that due importance is given to requisite intellectual and laboratory skills.

**Subject Title: “Industrial Chemistry (Elective)”**.

**B.Sc. (General) Semester V**

**Paper A:** Core 351, 352 & 353 i.e. Chemical Process Economics, 75
Industrial Organization & Industrial Chemical Analysis.

**B.Sc. (General) Semester VI**

**Paper B:** Core 364, 365 & 366/I or II or III or IV or V or VI or VII i.e. 75
out of Pharmaceuticals, Heavy & Fine chemicals, Petrochemicals, Waste recycling, Agrochemicals, Dyes & Polymers- any one elective is to be selected.

**Practicals:** (a) Practicals mentioned under B.Sc. III (**Semester V & VI**) 50

**NOTE:** The Entrepreneurship Development Course will be taught in the 3rd and 4th semester programme of B.A./B.Sc. This course being a non-credit course, the examination will be conducted by the Colleges themselves as they do for the House Examination. The result is to be conveyed in a sealed cover to be Deputy Registrar (Secrecy) P.U., Chandigarh well before the commencement of the annual Examination in April/May.
OBJECTIVE OF THE COURSE
To teach the fundamental concepts of Industrial Chemistry and their applications. The syllabus pertaining to B.Sc. (3 Year Course) in the subject of Chemistry has been upgraded as per provision of the UGC module and demand of the academic environment. The course contents have been revised from time to time as per suggestions of the teachers of the Chemistry working in the Panjab University, Chandigarh. The syllabus contents are duly arranged unit wise and contents are included in such a manner so that due importance is given to requisite intellectual and laboratory skills.

UNIT-I
Factors involved in project cost estimation, Methods employed for the estimation of capital investment. Capital formation, Elements of cost accounting Interest and investment costs, Time value of Money-equivalence. Some aspects of marketing pricing policy. Profitability criteria Economics of selecting Alternatives. Variation of cost with capacity break-even Point. Optimum batch sizes, production scheduling etc.

Suggested Books
Economics of Chemical Industry, Hempel. E.H

UNIT-II
Concept of scientific management in Industry Functions of management decision making Planning organizing directing and control. Location of industry, Materials management Inventory control Management of human resources-selection Incentives, welfare and safety.

Suggested Books
2. Industrisl Organization and Management, Bethel L.L.
3. Industrial Engineering and Management Science, Banga T.R.,Agarwal N.K
4. Business Organisation and Management, Bhushan Y.K.

UNIT-III
Industrial Analysis-
Sampling procedures sampling of bulks materials Techniques of sampling solids liquids and gases Advanced Chromatography techniques GLC, HPLC Particle size determination Rheological properties of liquids plastics and their analysis
UNIT-IV

Modern instrumental methods of analysis
Structure elucidation Problems based on combined UV, IR and NMR spectroscopy only be done (Students are expected to have done theory and principals of UV, IR and NMR in BSc III Organic Chemistry )

Suggested Books

Instructions for paper setters and candidates:
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II. The students are required to attempt FIVE questions in all, ONE question from each unit and the Compulsory question.
III. All questions carry equal marks.
B.Sc. Semester VI

B.Sc. THIRD YEAR ELECTIVE SUBJECTS
PAPER B
WASTE RECYCLING
OBJECTIVE OF THE COURSE

To teach the fundamental concepts of Industrial Chemistry and their applications. The syllabus pertaining to B.Sc. (3 Year Course) in the subject of Chemistry has been upgraded as per provision of the UGC module and demand of the academic environment. The course contents have been revised from time to time as per suggestions of the teachers of the Chemistry working in the Panjab University, Chandigarh. The syllabus contents are duly arranged unit wise and contents are included in such a manner so that due importance is given to requisite intellectual and laboratory skills.

UNIT-I

IC 351   Need for waste recycle: Limitations of raw material resources, waste elimination Conversion of waste into useful products Identification and quanlification of industrial domestic and agro waste. Feasibility of recycle, Separation of wastes-solid, Liquid, gaseous. 3L

Solid wastes: Removal of solid contaminants from water by coagulation, sedimentation, flocculation, solid waste disposal, incineration, fuel palletization, soil conditioning. 5L

Water management: Waste water treatment. Biological, physical and chemical treatment. 7L

UNIT-II

IC 352 Treatment of water and its reuse in industries, agriculture, oil refineries, thermal power station and domestic uses. Reuse of cooling water. 7L

Physical and chemical processes used for the recovery of Important compounds from waste Activated carbon adsorption, ion exchange process, evaporation, extraction, distillation, centrifugation, filtration, coagulation, membrane processes - osmosis, reverse osmosis, electrodialysis, advanced oxidation processes 8L

Unit III

IC 353 Pervaporation, freezing processes.

Biological processes for the treatment of waste water: Trickle filters, activated sludge process, microbial degradations. 4L

Gaseous wastes: Adsorption, catalytic/non-catalytic conversion recovery of important gases, CO₂, SO₂, NOₓ, etc., electrostatic precipitation, bag filters, wet/dry grid arrestors. 6L

Characterization of wastes, their management and
recovery of important compounds from the wastes from the following industries: Dyestuff, Fertilizers, Textile 5L

UNIT-IV

IC 354  Water treatment of following industries:
Oil, fats and soap iron and steel plants 5L
Tanneries, slaughter houses, rubber, sugar, heavy chemicals, fermentation 5L
Thermal power stations, electroplating, paper, paint.
Economics of recycling of waste 5L

SUGGESTED BOOKS


Instructions for paper setters and candidates:

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II. The students are required to attempt FIVE questions in all, ONE question from each unit and the Compulsory question.
III. All questions carry equal marks.

Practicals (B)

Estimations of SO₂, NH₃, NOₓ
Estimation of hardness, acidity, alkalinity and pH of water.
Estimation of BOC, COD content of effluent water from different industries.
Analysis of the solid contents from the liquid effluent from different industries, separation of the constituents, chromatographic separation-TLC, paper chromatography.
**Ion exchangers:** Ion exchange capacity of resins, softening of hard water, separation of important metals, Fe, Ni, Cr from the effluents and their estimations.
**Activated carbon:** Efficiency of carbon, adsorption isotherms, separation of some important chemicals by adsorption on carbon.
Fuel pallets from garbage and solid wastes. Calorific value.
The students are expected to collect solid and liquid wastes from nearby industries and analyse with respect to constituents recovery of important constituents and disposal methods.
OBJECTIVE OF THE COURSE

To teach the fundamental concepts of Industrial Chemistry and their applications. The syllabus pertaining to B.Sc. (3 Year Course) in the subject of Chemistry has been upgraded as per provision of the UGC module and demand of the academic environment. The course contents have been revised from time to time as per suggestions of the teachers of the Chemistry working in the Panjab University, Chandigarh. The syllabus contents are duly arranged unit wise and contents are included in such a manner so that due importance is given to requisite intellectual and laboratory skills.

UNIT-I
Pharmacopoeias-Development of India Pharmacopoeia and Introduction to B.P., U.S.P., E.P., N.F. and other important Pharmacopoeias.

Introduction to various types formulations and roots of Administration.

Aseptic conditions need for sterilisation, various methods of sterilisation.

A brief introduction to Glidants, lubricants, diluents, preservatives, antioxidants, emulsifying agents, coating agents binders, colouring agents, flavouring agents gelatin and other additives sorbitol, mannitol viscosity builders etc.

Suggested Books

UNIT-II
Surgical dressings sutures ligatures—with respect to the Process equipments used for manufacture method of sterilization And quality control.

Pharmaceutical packaging-Introduction package Selection, packaging materials, ancillary materials. Quality control of packaging materials. FDA, Important schedules and some legal aspects of drugs

Phytochemicals-Introduction to plant classification and Crude drugs cultivation collection preparation for the market and storage of medicinal plants.

Evaluation of crude drugs-Moisture content Extractive Value volatile oil content foreign organic matter.

Introduction to chromatographic method of identification of crude drugs.
**Suggested Books**


**UNIT-III**

Chemical constitution of plants: waxes, volatile oils, terpenoids, steroids, saponins, flavonoids, tannins, glycosides, alkaloids.

Various isolation procedures for active ingredients With example for alkaloid e.g., Vinca alkaloids, steroids; Sapogenin

Pharmaceutical quality control (other than the Analytical methods covered under core subject) Sterility testing Pyrogenic testing glass testing bulk density of powder etc.

Classification of various types of drugs with examples. Raw materials, process of manufacture effluent handling etc., of the following bulk drugs

1. Sulpha drugs-Sulphaguandine, sulphamethoxazole
2. Antimicrobial-chloramphenicol, furazolidine

**Suggested Books**

5. Indian Pharmacopoeia Commission, Indian Pharmacopoeia 2007, 3 Vols. with One Supplement (Addendum 2008).
UNIT-IV

Classification of various types of drugs with examples. Raw materials, process of manufacture effluent handling etc. of the following bulk drugs:
Steroidal hormones-Progesterone, Testosterone
Vitamins-Vitamin A, Vitamin C
Barbiturates-Pentobarbital
Bllickers- Propranolol, atenolol
Cardiovascular agent-Methyl dopa
Antihistamines-Chloropheniramine maleate.

General principle of fermentation processes and product processing.
Manufacture of antibiotics:Penicillin-G and semi synthetic penicillin,
Biotransformation processes-for prednisolone, 11-hydroxylation in steroids.
Enzyme catalyzed transformation manufacture of ephedrine.

Suggested Books
5. Indian Pharmacopoeia Commission, Indian Pharmacopoeia 2007, 3 Vols. with One Supplement (Addendum 2008).

Instructions for paper setters and candidates:
I. Examiner will set total of NINE questions comprising TWO questions from each unit and ONE compulsory question of short answer type covering whole syllabi.
II. The students are required to attempt FIVE questions in all, ONE question from each unit and the Compulsory question.
III. All questions carry equal marks.
Practicals (A)

1. Industrial Analysis-Analysis of common raw materials as per the industrial specifications, such as phenol, aniline, hydrogen peroxide, acetone, oils, etc. 6 expt

2. Synthesis of common industrial compounds involving two step reactions for example 4-Bromoaniline, 3-nitroaniline, sulphamidamide, 4-Aminobenzoic acid, 4-Nitrobenzoic acid, Dihalozenes, Nitrohalozenes 9 expt

Practicals (B)

1. Demonstration of various pharmaceutical packaging Materials, Quality control tests of some materials Aluminium strips, cartons, glass bottles. 2 expt.

2. Limit tests for chlorine, heavy metals, arsenic, Etc. of two representative bulk drug. 2 expt.

3. Demonstration of various pharmaceutical products. Active ingradient analysis of few types of formulations Representing different methods of analysis Acidimetry, Alkalimetry, nonaqueous complexometry, potentiometry etc. 3 expt.

4. Determination of sulphate ash, loss on drying and other tests of bulk drugs, complete I.P. monograph of three drugs representing variety of testing methods. 2 expt.


6. Microbiological testing-Determination of MTC of some antibacterial drugs by zone/cup plate method. 2 expt.

Instructions for paper setters and candidates:

General Instructions to the Examiners: Total Marks 50

Note: Practical examination will be of four hours duration & students shall perform three experiments:

Q1. Two experiments be set from Practical (A) part. Student to perform any one experiment. 12

Q2. Two experiments be set from Practicals (B) based on S.No. 1, 2, 3 Student to perform any one experiment. 12

Q3. Two experiments be set from Practicals (B) based on S.No. 4, 5, 6 Student to perform any one experiment. 12

Q4. Viva 08

Q5. Note Book 06
TRAINING/WORKSHOP/INDUSTRIAL VISITS (8 Credits)

1. Visit to a local industry during the year and students to submit a report on the same. The report should contain information about: Raw materials used in industry, Steps involved in manufacturing, Finished product and quality control measures involved.

   (Different from the one submitted in 1st Year)

2. Students will also submit a project report on water-effluent analysis/soil analysis/food adulteration etc.(Different from the one submitted in first year)

3. Each Student to present a seminar relevant to the syllabus.