

**BHAVNAGAR UNIVERSITY**

**BHAVNAGAR**

**(NACC Accreditation Grade “B”)**

**CREDIT AND SEMESTER SYSTEM**

**SYLLABUS**

**MASTER OF SCIENCE (M.Sc.)**

**INDUSTRIAL CHEMISTRY**

**(In Force From Academic Year: 2010-2011)**

तमसो मा ज्योतिर्गमय



**M.Sc.**  
Credit and Semester System Syllabus

**NAME OF THE SUBJECT: INDUSTRIAL CHEMISTRY**

**SEMESTER – 1<sup>st</sup>**

<b>SR. NO.</b>	<b>PAPER NO</b>	<b>NAME OF THE PAPER</b>	<b>TOTAL MARKS EXT + INT = TOTAL</b>	<b>PASSING STANDARD EXT + INT = TOTAL</b>	<b>TOTAL TEACHING HOURS</b>	<b>EXAM HOURS</b>	<b>CREDITS</b>
1	IC-1	Unit operations & Unit processes – I	70 + 30 = 100	28 + 12 = 40	15 Weeks x 04 Hours = 60	03	04
2	IC-2	Instrumentation	70 + 30 = 100	28 + 12 = 40	15 Weeks x 04 Hours = 60	03	04
3	IC-3	Environmental pollution analysis	70 + 30 = 100	28 + 12 = 40	15 Weeks x 04 Hours = 60	03	04
4	IC-4	Practicals	100 + 00 = 100	40 + 00 = 40	15 Weeks x 15 Hours = 225	3.5*4=14	15

<b>* INTERNAL</b>	<b>MARKS</b>
ATTENDANCE	05
ASSIGNMENT	05
SEMINAR	10
TEST	10



**M.Sc.**  
Credit and Semester System Syllabus

**NAME OF THE SUBJECT: INDUSTRIAL CHEMISTRY**

**SEMESTER – 2<sup>nd</sup>**

<b>SR. NO.</b>	<b>PAPER NO</b>	<b>NAME OF THE PAPER</b>	<b>TOTAL MARKS EXT + INT = TOTAL</b>	<b>PASSING STANDARD EXT + INT = TOTAL</b>	<b>TOTAL TEACHING HOURS</b>	<b>EXAM HOURS</b>	<b>CREDITS</b>
1	IC-5	Chemical Process Industries	70 + 30 = 100	28 + 12 = 40	15 Weeks x 04 Hours = 60	03	04
2	IC-6	Organic Chemistry	70 + 30 = 100	28 + 12 = 40	15 Weeks x 04 Hours = 60	03	04
3	IC-7	Chemical Kinetics & Material Science	70 + 30 = 100	28 + 12 = 40	15 Weeks x 04 Hours = 60	03	04
4	IC-8	Practicals	100 + 00 = 100	40 + 00 = 40	15 Weeks x 15 Hours = 225	3.5*4=14	15

<b>* INTERNAL</b>	<b>MARKS</b>
ATTENDENCE	05
ASSIGNMENT	05
SEMINAR	10
TEST	10



**M.Sc.**  
Credit and Semester System Syllabus

**NAME OF THE SUBJECT: INDUSTRIAL CHEMISTRY**

**SEMESTER – 3<sup>rd</sup>**

<b>SR. NO.</b>	<b>PAPER NO</b>	<b>NAME OF THE PAPER</b>	<b>TOTAL MARKS EXT + INT = TOTAL</b>	<b>PASSING STANDARD EXT + INT = TOTAL</b>	<b>TOTAL TEACHING HOURS</b>	<b>EXAM HOURS</b>	<b>CREDITS</b>
1	IC-9	Industrial management and Safty	70 + 30 = 100	28 + 12 = 40	15 Weeks x 04 Hours = 60	03	04
2	IC-10	Measurement, Process Control & Energy sources	70 + 30 = 100	28 + 12 = 40	15 Weeks x 04 Hours = 60	03	04
3	IC-11	Unit operations & Unit processes – II	70 + 30 = 100	28 + 12 = 40	15 Weeks x 04 Hours = 60	03	04
4	IC-12	Practicals	100 + 00 = 100	40 + 00 = 40	15 Weeks x 15 Hours = 225	3.5*4=14	15

<b>* INTERNAL</b>	<b>MARKS</b>
ATTENDENCE	05
ASSIGNMENT	05
SEMINAR	10
TEST	10



**M.Sc.**  
Credit and Semester System Syllabus

**NAME OF THE SUBJECT: INDUSTRIAL CHEMISTRY**

**SEMESTER – 4<sup>th</sup>**

<b>SR. NO.</b>	<b>PAPER NO</b>	<b>NAME OF THE PAPER</b>	<b>TOTAL MARKS EXT + INT = TOTAL</b>	<b>PASSING STANDARD EXT + INT = TOTAL</b>	<b>TOTAL TEACHING HOURS</b>	<b>EXAM HOURS</b>	<b>CREDITS</b>
1	IC-13	Petrochemical and Polymer	70 + 30 = 100	28 + 12 = 40	15 Weeks x 04 Hours = 60	03	04
2	IC-14	Technology of Selected Finished products – Dyes	70 + 30 = 100	28 + 12 = 40	15 Weeks x 04 Hours = 60	03	04
3	IC-15	Technology of Selected Finished products – Drugs	70 + 30 = 100	28 + 12 = 40	15 Weeks x 04 Hours = 60	03	04
4	IC-16	Practicals	100 + 00 = 100	40 + 00 = 40	15 Weeks x 15 Hours = 225	3.5*4=14	15

<b>* INTERNAL</b>	<b>MARKS</b>
ATTENDANCE	05
ASSIGNMENT	05
SEMINAR	10
TEST	10



**Faculty of Science M.Sc. (Industrial Chemistry)**  
**Semester Scheme**

**REGULATIONS:**

**1. Admission:-**

For the admission to M.Sc.(I.C) a candidate must have a Degree of Bachelor of Science of the University or a Degree recognized as equivalent thereto, with minimum second class (48%) or equivalent in Grade System.

No candidate for the M.Sc. Degree Examination can select a subject other than one offered by him/her as a special subject at the B.Sc. Examination or as Principal subject at the B.Sc. Degree Examination.

2. To pass the whole M.Sc.(I.C) Examination, student should clear all the four semester examinations within a period of five years from the date of registration. After five years, he/she shall be required register himself/herself as a fresh candidate, and keep the attendance and appear and pass in the four semester examinations a fresh from first semester onwards to obtain the Degree of Master of Science.
3. There shall be an examination at the end of each of four semesters to be known as First Semester Examination, Second Semester Examination, Third Semester Examination and Fourth Semester Examination respectively at which a student shall appear in that portion of papers, practical and viva-voce if any, for which he has kept the terms in accordance with the regulations in this behalf. Field study tours/academic visits to laboratories, private companies will be compulsory and the journals, certified reports will be submitted by the students at the time of practical examination.
4. To pass the M.Sc. (I.C) degree examinations a candidate shall, be required to obtain, separately not less than 40% of the total marks in (I) each paper and (II) practical's if any, and (III) viva-voce examination, if any. The same rule should be applied where internal examinations are conducted. i.e. 40% passing in internal as well as external by paper.
5. Classes shall be awarded at the M.Sc. (I.C) degree in the manner specified here in below, namely
  - (I) A successful candidate who obtains not less than 70 percent of the total marks obtainable in the aggregate of the four examinations shall be placed in the First Class with Distinction.
  - (II) A successful candidate who obtains less than 70 percent but not less than 60 percent of the total marks obtainable in the aggregate of the four examinations shall be placed in the First Class.
  - (III) A successful candidate who obtains less than 60 percent but not less than 48 percent of the total marks obtainable in the aggregate in the four examinations shall be placed in the Second Class.
  - (IV) A successful candidate who obtains less than 48 percent of the total marks obtainable in the aggregate in the four examinations shall be placed in the Pass Class.
6. No student will be allowed to reappear in a paper or practical or viva-voce or semester examination when he/she has cleared it once.
7. Students will be promoted to second semester irrespective of his/her result of the first semester but will not be promoted to the third semester if he/she does not pass the first semester and the students will be promoted to the fourth semester irrespective of his/her result of the third semester but he/she must have passed the first and second semester.



**Detailed Syllabus**

(With effect from Academic Year 2010-2011)

**Semester I**

**M.Sc. Industrial Chemistry**

**Core Paper No: IC-1**

Title of the Paper: **UNIT OPERATIONS & UNIT PROCESSES - I**

Marks: **100 Marks**

**Credits: 04**

Marks: Semester End Examination: **70 Marks**

Continuous Internal Evaluation: **30 Marks**

Unit	Detailed Syllabus	Teaching Hours	Marks/Weight
Unit 1	<ul style="list-style-type: none"><li>❖ Crystallization:-Theory of crystallization, equipments of crystallizer.(Tank crystallizer, Packed tower crystallizer, Evaporator crystallizer, Draft tube crystallizer)</li><li>❖ Absorption:-Theory of absorption, spray column, packed column absorber.</li></ul>	12	14 + 6 = 20
Unit 2	<ul style="list-style-type: none"><li>❖ Mixing:- Introduction, Mixing of liquid-liquid, solid – liquid &amp; it's calculation.</li><li>❖ Size reduction:- Introduction, Theory of size reduction &amp; Equipments.</li></ul>	12	14 + 6 = 20
Unit 3	<ul style="list-style-type: none"><li>❖ Introduction, Kinetics &amp; Mechanism of Amination. (Industrial production of any two compound by Amination)</li><li>❖ Introduction, Kinetics &amp; Mechanism of Sulphonation. (Industrial production of any two compound by Sulphonation)</li></ul>	12	14 + 6 = 20
Unit 4	<ul style="list-style-type: none"><li>❖ Introduction, Kinetics &amp; Mechanism of Hydrogenation. (Industrial production of any two compound by Hydrogenation)</li><li>❖ Introduction, Kinetics &amp; Mechanism of Halogenations. (Industrial production of any two compound by Halogenations.)</li></ul>	12	14 + 6 = 20
Unit 5	<ul style="list-style-type: none"><li>❖ Introduction, Kinetics &amp; Mechanism of Alkylation. (Industrial production of any two compound by Alkylation)</li><li>❖ Introduction, Kinetics &amp; Mechanism of Hydrolysis. (Industrial production of any two compound by Hydrolysis)</li></ul>	12	14 + 6 = 20

**Break up of Continuous Internal Evaluation:**

1. Assignment: 05 Marks
  2. Attendance: 05 Marks
  3. Seminar: 10 Marks
  4. Test: 10 Marks
- Total Marks: 30 Marks**

**Reference / Text-Books / Additional Reading:**

1. Introduction to chemical engineering By Walter L. Badger, J. T. Bancharo, McGraw Hill Book Co..
2. Chemical engineering Vol. 1 to 6 By Coulson and J.F.Richardson, Pergaman Press
3. Chemical process principles Vol.1 by Hodgen
4. Stoichiometry by B.I., Bhatt and S.M.Vora, Tata McGraw hill book co.
5. Basic principles and calculations in chemical engineering by D.N.Bhamm, Prentice Hall Co,
6. Elementary principles of chemical processes by Richa Ronald, W. Rousseau, John Willey and Son.
7. Unit processes in organic synthesis by P. H. Groggins.



**Detailed Syllabus**  
(With effect from Academic Year 2010-2011)

**Semester I**

**M.Sc. Industrial Chemistry**

**Core Paper No: IC-2**

Title of the Paper: **INSTRUMENTATION**

Marks: **100 Marks**

Credits: 04

Marks: Semester End Examination: **70 Marks**

Continuous Internal Evaluation: **30 Marks**

Unit	Detailed Syllabus	Teaching Hours	Marks/Weight
Unit 1	❖ Principles, Construction and working of the following measuring equipments:- - <b>Temperature:</b> Glass Thermometer, Bimetallic thermometer, Pressure spring thermometer, Vapour filled thermometer, Resistance thermometer. - <b>Viscosity:</b> Capillary tube Viscometer, falling sphere viscometer, Rotating cylinder viscometer, viscosity sensitive rotameter. - <b>Density &amp; Specific gravity:</b> Pycnometer, Hydrometer, Specific gravity balance. - <b>Liquid Level:</b> Direct & indirect liquid level methods.	12	14 + 6 = 20
Unit 2	❖ Colorimetry:- - General discussion. - Theory of Colorimetry. - Colorimetric methods and apparatus.	12	14 + 6 = 20
Unit 3	❖ Analytical and testing instrumentation:- - Ultra-Violet and Visible Spectrometers, - Infra-Red Spectrometers and analyzers, Mass Spectrometers, - Thermal Conductivity analyzers, - Oxygen analyzers.	12	14 + 6 = 20
Unit 4	❖ pH, Conductimetry and Potentiometry measuring systems. - Methods and apparatus	12	14 + 6 = 20
Unit 5	❖ Chromatographic techniques. - Gas chromatography. - Liquid chromatography. - Paper chromatography. - Ion-exchange chromatography.	12	14 + 6 = 20

**Break up of Continuous Internal Evaluation:**

1. Assignment: 05 Marks
  2. Attendance: 05 Marks
  3. Seminar: 10 Marks
  4. Test: 10 Marks
- Total Marks: 30 Marks**

**Reference / Text-Books / Additional Reading:**

1. Chemical engineering kinetics by J.M.Smith, McGraw hill book Co.
2. Chemical kinetics by S.K.Jain, Vishal publication.
3. Industrial analysis by B.K.Sharma, Gael publication.
4. Principles of analytical chemistry by R.K. Shah, J.C. Vora, K. P. Vora and R. S. Shah.
5. Physico-chemical exercise by P. H. Parsania.



**Detailed Syllabus**  
(With effect from Academic Year 2010-2011)

**Semester I**

**M.Sc. Industrial Chemistry**

Core Paper No: **IC-3**

Title of the Paper: **ENVIRONMENTAL POLLUTION ANALYSIS**

Marks: **100 Marks**

Credits: **04**

Marks: Semester End Examination: **70 Marks**

Continuous Internal Evaluation: **30 Marks**

Unit	Detailed Syllabus	Teaching Hours	Marks/Weight
Unit 1	❖ Environmental pollution:- - Air pollution - Water pollution - Land pollution - Noise pollution	12	14 + 6 = 20
Unit 2	❖ Air pollution analysis:- - Structure of Atmosphere. - Effect of air pollution on Man and Materials. - Classification of air pollution. - Analysis of SO <sub>2</sub> , H <sub>2</sub> S, NO-NO <sub>x</sub> , CO-CO <sub>2</sub> ,	12	14 + 6 = 20
Unit 3	❖ Water pollution analysis:- - Physical examination of water. - Chemical characterization of water. - Minor components of water. - Biological investigation of water.	12	14 + 6 = 20
Unit 4	❖ Land pollution analysis:- - Chemistry of land. - Land irrigation by effluents. - Analysis of micronutrients in land. - Trace element analysis in land.	12	14 + 6 = 20
Unit 5	❖ Noise pollution & its measurement:- - Source of noise. - Types of noise. - Noise measurement. - Noise mapping.	12	14 + 6 = 20

**Break up of Continuous Internal Evaluation:**

1. Assignment: 05 Marks
  2. Attendance: 05 Marks
  3. Seminar: 10 Marks
  4. Test: 10 Marks
- Total Marks: 30 Marks**

**Reference / Text-Books / Additional Reading:**

1. Environmental pollution analysis by S. M. Khopkar.
2. Chemical kinetics by S.K.Jain, Vishal publication.
3. Industrial analysis by B.K.Sharma, Gael publication.
4. Shreve's chemical process industries 5<sup>th</sup> Edition.



**Detailed Syllabus**  
(With effect from Academic Year 2010-2011)

**Semester I**

**M.Sc. Industrial Chemistry**

Core Paper No: **IC-4**

Title of the Paper: Industrial Chemistry Practicals

Marks: **100 Marks**

Credits: **15**

Unit	Detailed Syllabus	Teaching Hours	Marks/Weight
Unit 1	♣ Preparation of fine chemicals (Minimum 10)	35	50
Unit 2	♣ Physico-chemical Experiments (Minimum 8)	25	25
Unit 3	♣ Viva-voce (Questions related to fundamentals of Industrial Chemistry and topics related to the syllabus of M.Sc. Industrial Chemistry)	-	25

**Reference / Text-Books / Additional Reading:**

1. Vogel's Textbook of Practical Organic Chemistry, 5th Edition by B. S. Furniss et al.
2. Comprehensive Practical Organic Chemistry, Qualitative Analysis by V. K. Ahluwalia
3. Comprehensive Practical Organic Chemistry, Inorganic Preparation by V. K. Ahluwalia
4. Physico-chemical exercise by P. H. Parsania



**Detailed Syllabus**  
(With effect from Academic Year 2010-2011)

**Semester II**

**M.Sc. Industrial Chemistry**

**Core Paper No: IC-5**

**Title of the Paper: CHEMICAL PROCESS INDUSTRIES**

**Marks: 100 Marks**

**Credits: 04**

**Marks: Semester End Examination: 70 Marks**

**Continuous Internal Evaluation: 30 Marks**

Unit	Detailed Syllabus	Teaching Hours	Marks/Weight
Unit 1	❖ Surface coating industries:- - Theory of corrosion and erosion, - Corrosion reactions, - Factor affecting corrosion rates, - Protection against corrosion.	12	14 + 6 = 20
Unit 2	❖ Food, fragrances, flavors and food additives. ❖ Fermentation:- - Manufacture of Industrial alcohol, absolute alcohol, Butanol, Acetone, Acetic acid, and Citric acid.	12	14 + 6 = 20
Unit 3	❖ Fine chemicals obtained from marine:- - Industrial manufacture salts of Mg. - Industrial manufacture salts of Ca. - Industrial manufacture salts of K. - Industrial manufacture salts of Na.	12	14 + 6 = 20
Unit 4	❖ Explosives and Propellants:- - Types. - Characteristic. - Industrial production of (Nitro, Nitramine, Nitramide, RDX, HMX) explosives.	12	14 + 6 = 20
Unit 5	❖ Synthetic rubber:- - Importance. - Types. - Refining. - Vulcanization. - Industrial production.	12	14 + 6 = 20

**Break up of Continuous Internal Evaluation:**

1. Assignment: 05 Marks
  2. Attendance: 05 Marks
  3. Seminar: 10 Marks
  4. Test: 10 Marks
- Total Marks: 30 Marks**

**Reference / Text-Books / Additional Reading:**

1. Reigel's handbook of industrial chemistry by James a. Kent von-nastrand Reinhold co.
2. A chemical process industry by R. N. shrives McGraw hill book co.
3. Outline of chemical engineering by Dryden.
4. Chemical technology vol. 1 & 2 by S. chand and co. New Delhi.
5. Industrial chemistry by B.K.Sharma, Gael publication.



**Detailed Syllabus**  
(With effect from Academic Year 2010-2011)

**Semester II**

**M.Sc. Industrial Chemistry**

**Core Paper No: IC-6**

**Title of the Paper: ORGANIC CHEMISTRY**

**Marks: 100 Marks**

**Credits: 04**

**Marks: Semester End Examination: 70 Marks**

**Continuous Internal Evaluation: 30 Marks**

Unit	Detailed Syllabus	Teaching Hours	Marks/Weight
Unit 1	<ul style="list-style-type: none"><li>❖ Stereo chemistry:<ul style="list-style-type: none"><li>- Introduction to conformation and conformational analysis.</li><li>- Conformation of cyclohexane and its mono, di and poly substitute derivatives.</li><li>- Declain, perhydroanthracene, perhydrophenanthrene, role of spectroscopy in the study of conformational analysis.</li><li>- Conformational and reactivity.</li></ul></li></ul>	12	14 + 6 = 20
Unit 2	<ul style="list-style-type: none"><li>❖ Reactions:<ul style="list-style-type: none"><li>- Introduction &amp; Mechanism of Mannich</li><li>- Introduction &amp; Mechanism of Oppanauer oxidation.</li><li>- Introduction &amp; Mechanism of Meerven-pondorf-verley reduction.</li><li>- Introduction &amp; Mechanism of Ullman reaction.</li><li>- Introduction &amp; Mechanism of Sandmayer reaction.</li><li>- Introduction &amp; Mechanism of Buckerer reaction.</li><li>- Introduction &amp; Mechanism of Grignard reaction.</li></ul></li></ul>	12	14 + 6 = 20
Unit 3	<ul style="list-style-type: none"><li>❖ Rearrangement:<ul style="list-style-type: none"><li>- Introduction &amp; Mechanism of Fries rearrangement.</li><li>- Introduction &amp; Mechanism of Benzidine rearrangement.</li><li>- Introduction &amp; Mechanism of Von Richter rearrangement.</li><li>- Introduction &amp; Mechanism of Whitmore rearrangement.</li><li>- Introduction &amp; Mechanism of Schmidt rearrangement.</li><li>- Introduction &amp; Mechanism of Hoffman rearrangement.</li><li>- Introduction &amp; Mechanism of Curties rearrangement.</li></ul></li></ul>	12	14 + 6 = 20
Unit 4	<ul style="list-style-type: none"><li>❖ Reagents:<ul style="list-style-type: none"><li>- N-bromosuccinamide.</li><li>- Aluminum isopropoxide.</li><li>- Polyphosphoric acid.</li><li>- Sodium borohydride.</li><li>- Alizarin.</li><li>- Lithium Aluminium Hydride.</li><li>- 8-Hydroxy Quinoline.</li></ul></li></ul>	12	14 + 6 = 20
Unit 5	<ul style="list-style-type: none"><li>❖ Preparations (Two) and Reactions (Two) of:<ul style="list-style-type: none"><li>- Pyrazole, imidazole, Oxazole and Thiazole.</li><li>- Pyridiazines, Pyrimidines and Pyroxines.</li><li>- Fused systems; Benzofuran, Indole and Benzothiophen.</li><li>- Organometalic compounds, inorganic Synthesis.</li></ul></li></ul>	12	14 + 6 = 20



**Break up of Continuous Internal Evaluation:**

1. Assignment:	05 Marks
2. Attendance:	05 Marks
3. Seminar:	10 Marks
4. Test:	<u>10 Marks</u>
<b>Total Marks:</b>	<b>30 Marks</b>

**Reference / Text-Books / Additional Reading:**

1. Advanced Organic Chemistry 3<sup>rd</sup> edition by Jerry March, Willey Eastem Limited.
2. Organic Chemistry 6<sup>th</sup> Edition by Morrison and Boyd Pranatice Hall of India Private Limited.
3. Organic Chemistry Vol. 1 & 2 by I. L. Finar
4. Current Topic in Organics Chemistry Vol.1, Fiwser & Feisher, Reiniod.



**Detailed Syllabus**  
(With effect from Academic Year 2010-2011)

**Semester II**

**M.Sc. Industrial Chemistry**

Core Paper No: **IC-7**

Title of the Paper: **CHEMICAL KINETICS & MATERIAL SCIENCE**

Marks: **100 Marks**

Credits: **04**

Marks: Semester End Examination: **70 Marks**

Continuous Internal Evaluation: **30 Marks**

Unit	Detailed Syllabus	Teaching Hours	Marks/Weight
Unit 1	❖ Catalysis:- - Introduction - Types of catalytic reactions. - Characteristics of catalyst. - Theory of the mechanism of catalysis. - Catalytic poisons & inhibitors.	12	14 + 6 = 20
Unit 2	❖ Industrial Carbon (Industrial production):- - Carbon Black. - Graphite. - Industrial Diamonds. - Lamp black. - Fullerene	12	14 + 6 = 20
Unit 3	❖ Chlor-Alkali Industries (Industrial production):- - Soda Ash. - Caustic Soda - Chlorine - Sodium bicarbonate - Sodium Chloride	12	14 + 6 = 20
Unit 4	❖ Mechanical, physical, dimensional properties and uses of:- - Cement. - Glasses. - Ceramics. - Refractories	12	14 + 6 = 20
Unit 5	❖ Mechanical, physical, dimensional properties and uses of Alloys:- - Brass - Steel - Bronze - German silver - Aluminium	12	14 + 6 = 20

**Break up of Continuous Internal Evaluation:**

1. Assignment: 05 Marks
  2. Attendance: 05 Marks
  3. Seminar: 10 Marks
  4. Test: 10 Marks
- Total Marks: 30 Marks**



**Reference / Text-Books / Additional Reading:**

1. Reigel's handbook of industrial chemistry by James a. Kent von-nastrand Reinhold co.
2. A chemical process industry by R. N. shrives McGraw hill book co.
3. Industrial chemistry by B.K.Sharma, Gael publication.
4. A chemical process industry by R. N. shrives McGraw hill book co.
5. Chemical Engineering material by O. V. Agrawal.
6. Industrial chemistry by B.K.Sharma, Gael publication.
7. Materials Science by C.Kulkarni and R.S.Sedha. S.Chand and Co. Ltd. New Delhi.
8. Materials Science and Engineering by V.Raghavan. Prentice Hall and India Ltd.
9. Materials Science C.B.S. Narang Khanna Publishers
10. Science of engineering Materials by C.M. Shrivastav and Shrinivasan, Wiley Estern Limited
11. A Text book of Engineering Materials by B.N. Das and S.L. Chawla, Orient Long Mark Pvt Ltd.



**Detailed Syllabus**  
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**Semester II**

**M.Sc. Industrial Chemistry**

Core Paper No: **IC-8**

Title of the Paper: Industrial Chemistry Practicals

Marks: **100 Marks**

Credits: **15**

Unit	Detailed Syllabus	Teaching Hours	Marks/Weight
Unit 1	❖ Separation of Organic Mixture (Three component- Minimum 10 Mixture)	45	50
Unit 2	❖ Organic Estimation	15	25
Unit 3	❖ Viva-voce (Questions related to fundamentals of Industrial Chemistry and topics related to the syllabus of M.Sc. Industrial Chemistry)	-	25

**Reference / Text-Books / Additional Reading:**

1. Vogel's Textbook of Practical Organic Chemistry, 5<sup>th</sup> Edition by B. S. Furniss et al.
2. Comprehensive Practical Organic Chemistry, Qualitative Analysis by V. K. Ahluwalia
3. Comprehensive Practical Organic Chemistry, Organic Preparation by V. K. Ahluwalia







**Detailed Syllabus**  
(With effect from Academic Year 2010-2011)

**Semester III**

**M.Sc. Industrial Chemistry**

**Core Paper No: IC-11**

**Title of the Paper: UNIT OPERATION & UNIT PROCESSES -II**

**Marks: 100 Marks**

**Credits: 04**

**Marks: Semester End Examination: 70 Marks**

**Continuous Internal Evaluation: 30 Marks**

Unit	Detailed Syllabus	Teaching Hours	Marks/Weight
Unit 1	<ul style="list-style-type: none"><li>❖ Filtration:-<ul style="list-style-type: none"><li>- Theory of filtration, calculation of filters, equipments (Filter Press, Centrifuge, Bag filter)</li></ul></li><li>❖ Drying:-<ul style="list-style-type: none"><li>- Theory of drying, calculation of drying, equipments (Try Dryer, Spray Dryer, Drum Dryer)</li></ul></li></ul>	12	14 + 6 = 20
Unit 2	<ul style="list-style-type: none"><li>❖ Extraction:-<ul style="list-style-type: none"><li>- Calculation of number of stages for extraction, equipments (Spray column, Packed column, RDC)</li></ul></li><li>❖ Distillation:-<ul style="list-style-type: none"><li>- Construction and working of distillation column, sieve plate &amp; bubble cap and packed towers.</li></ul></li></ul>	12	14 + 6 = 20
Unit 3	<ul style="list-style-type: none"><li>❖ Introduction, Kinetics &amp; Mechanism of Nitration. (Industrial production of any two compound by Nitration)</li><li>❖ Introduction, Kinetics &amp; Mechanism of Oxidation. (Industrial production of any two compound by Oxidation.)</li></ul>	12	14 + 6 = 20
Unit 4	<ul style="list-style-type: none"><li>❖ Introduction, Kinetics &amp; Mechanism of Reduction. (Industrial production of any two compound by Reduction)</li><li>❖ Introduction, Kinetics &amp; Mechanism of Esterification. (Industrial production of any two compound by Esterification.)</li></ul>	12	14 + 6 = 20
Unit 5	<ul style="list-style-type: none"><li>❖ Introduction &amp; Mechanism of Mechanical Separation.</li><li>❖ Introduction &amp; Mechanism of Handling of Solids.</li><li>❖ Introduction &amp; Mechanism of Mixing.</li></ul>	12	14 + 6 = 20

**Break up of Continuous Internal Evaluation:**

1. Assignment: 05 Marks
  2. Attendance: 05 Marks
  3. Seminar: 10 Marks
  4. Test: 10 Marks
- Total Marks: 30 Marks**

**Reference / Text-Books / Additional Reading:**

1. Introduction to chemical engineering By Walter L. Badger, J. T. Bancharo, McGraw Hill Book Co..
2. Chemical engineering Vol. 1 to 6
3. By Coulson and J.F.Richardson, Pergaman Press
4. Fundamental of engineering heat and mass transfer.
5. Process heat transfer by Kerm, D.Q.McGraw hill book co.
6. Chemical process principles Vol.1 by Hodgen
7. Stoichiometry by B.I., Bhatt and S.M.Vora, Tata McGraw hill book co.
8. Basic principles and calculations in chemical engineering by D.N.Bhamm, Prentice Hall Co,
9. Elementary principles of chemical processes by Richa Ronald, W. Rousseau, John Willey and Son.
10. Unit processes in organic synthesis by P. H. Groggins.



**Detailed Syllabus**  
(With effect from Academic Year 2010-2011)

**Semester III**

**M.Sc. Industrial Chemistry**

Core Paper No: **IC-12**

Title of the Paper: Industrial Chemistry Practicals

Marks: **100 Marks**

Credits: **15**

Unit	Detailed Syllabus	Teaching Hours	Marks/Weight
Unit 1	❖ Ore / Alloy analysis ( Minimum 8)	30	50
Unit 2	❖ Instrumental Exercise (Minimum10)	30	25
Unit 3	❖ Viva-voce (Questions related to fundamentals of Industrial Chemistry and topics related to the syllabus of M.Sc. Industrial Chemistry)	-	25

**Reference / Text-Books / Additional Reading:**

1. Vogel's Textbook of Practical Organic Chemistry, 5<sup>th</sup> Edition by B. S. Furniss et al.
2. Comprehensive Practical Inorganic Chemistry, Qualitative Analysis by V. K. Ahluwalia
3. Physico-chemical exercise by P. H. Parsania.









**Detailed Syllabus**  
(With effect from Academic Year 2010-2011)

**Semester IV**

**M.Sc. Industrial Chemistry**

Core Paper No: **IC-16**

Title of the Paper: Industrial Chemistry Practicals

Marks: **100 Marks**

Credits: **15**

Unit	Detailed Syllabus	Teaching Hours	Marks/Weight
Unit 1	❖ Preparation of synthetic Drugs / Dyes ( Three Steps - Minimum 10)	45	50
Unit 2	❖ Dyeing Process (Minimum 5) ❖ Project Reports / Seminar (Field study tours/academic visits to laboratories, private companies will be compulsory)	15	25
Unit 3	❖ Viva-voce (Questions related to fundamentals of Industrial Chemistry and topics related to the syllabus of M.Sc. Industrial Chemistry)	-	25

**Reference / Text-Books / Additional Reading:**

1. Vogel's Textbook of Practical Organic Chemistry, 5<sup>th</sup> Edition by B. S. Furniss et al.
2. Comprehensive Practical Inorganic Chemistry, Qualitative Analysis by V. K. Ahluwalia
3. Chemistry of Dyes & Principles of Dyeing, Sevak Publications by V. A. Sheni.
4. Dyeing and Chemical Technology of Textile fabrics by E. R. Trotman.