4. To determine the Concentration of sugar solution by half shade polarimeter.
5. To determine the wavelength of monochromatic light by plane diffraction grating.
6. To find the number of lines per centimeter of the given grating.
7. To determine the resolving power of plane diffraction grating.
8. To determine the resolving power of telescope.
9. To determine the wavelength of laser light.
10. Determination of refractive index of a prism by spectrometer.
11. Determination of dispersive power of prism material
12. To determine the resolving power of prism.
13. study of interference of light by bi-prism experiment and find the wavelength of sodium light.
14. To verify the law of Malus of plane polarized light.
15. Polarplots of solarpanel
16. Measurement of direct radiation using Pyrheliometer .
17. Measurement of global & diffuse radiation using pyranometer
18. Determination of solar constant
19. To determine frequency and phase of signal using CRO.
20. To determine capacitance by Scherring bridge method.
21. To determine self inductance by bridge rectifier method.
22. To determine frequency of AC mains by Sonometer.
23. To study and plot I-V characteristics of solar cell.
24. To study time constant of an RC circuit experimentally and verify the result theoretically.
25. Verification of Stefan's law of radiation by using an incandescent lamp as black body Radiator.
26. To study (a) Half-wave Rectifier and (b) Full-wave Bridge Rectifier and investigate the effect of C, L and π filters.

REFFERENCE BOOKS:

1. Laser and non-linear optics ï B B Laud.
2. Optoelectronics and fiber optics communication ï C.K Sarkar, D.C. Sarkar.
3. An introduction to fiber optics ï R. Allen Shotwell
4. Optics ï Ajoy Ghatak.
5. Optical fiber Communication ï John M. Senior
6. Principles of optics ï B.K.Mathur
7. Optics and laser ï V.K. Sewane

8. Optics and atomic physics ï D.P.Khandelwal.
9. Non Conventional Energy Sources, G. D. RAI(4th edition), Khanna Publishers, Delhi.
10. Solar Energy, S.P. Sukhatme (second edition), Tata Mc. Graw Hill Ltd, New Delhi.
11. Solar Energy Utilisation, G. D. RAI (5th edition), Khanna Publishers,Delhi.
12. Principles of Solar Energy - Kreith Kreider.
13. Renewable Energy - BentSarensen.

3. Chemistry
3S Chemistry
(Effective from session 2014-15)

The examination in Chemistry of Third semester shall comprise of one theory paper, internal assessment and practical examination. Theory paper will be of 3 Hrs. duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of 6 hours duration and carry 50 marks.

The following syllabi is prescribed on the basis of six lectures per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question in every unit with internal choice for each of 12 marks & one compulsory question covering all the syllabus of Semester-III (8 marks).

B.Sc. Part- II (Semester- III)

3S Chemistry

Total Lectures: 84

Marks: 80

Note: Figures to the right hand side indicate number of lectures.

Unit I **14L**

A] Covalent Bonding:

Molecular Orbital Theory. Postulates of MO theory. LCAO approximation. Formation of bonding and antibonding MOs. Rules for LCAO. MO energy level diagram. Concept of bond order. MO structure of homonuclear diatomic molecules of namely He_2, H_2, N_2 and O_2. Stability sequence of species of O_2 i.e. O_2, O_2^+, O_2^{2+}, O_2^- and O_2^{2-}. Paramagnetic nature of O_2. MO structure of heteronuclear diatomic molecules viz. NO, HF and CO (Coulsonôs structure). Explanation of important properties of CO viz. - triple

bond, almost nonpolar nature, electron donor and acceptor behaviour. Comparison of VB and MO theories. **[6]**

B] Metallic Bonding:

Free electron theory and properties of metals such as electrical and thermal conduction, malleability, ductility and metallic lusture. VB theory or Resonance theory of metals. Band theory to explain nature of conductors, insulators and semiconductors (both intrinsic and extrinsic). **[3]**

C] VSEPR Theory:

Various rules under VSEPR theory to explain molecular geometry (following examples may be taken to explain various rules- $BeCl_2$, BF_3, CH_4 , NH_4^+ , PCl_5 , SF_6, IF_7, $SnCl_2$, NH_3, H_2O, SF_4, ClF_3, BrF_5, XeF_6, SOF_4, COF_2, PCl_3,). Limitations of VSEPR theory. **[5]**

Unit II - Theory of Quantitative Inorganic Analysis 14L

A] Volumetric Analysis:

(a) Introduction:-Volumetric analysis, titrant, titrate, end point, equivalence point, indicator etc. Requirements of volumetric analysis. Definition of standard solution, primary standard substance. Requirements of primary standard substance. Terms to express concentrations namely- molarity, normality, molality, mole fraction and percentage. (Simple numericals expected).

(b) Acid-Base titrations:- Types of acid base titrations. pH variations during acid base titration. Acid base indicators. Modern theory (Quinoniod theory) of acid base indicators. Choice of suitable indicators for different acid base titrations.

(c) Redox Titrations:-General principles involved in redox titrations (redox reactions, redox potentials, oxidant, reductant, oxidation number). Brief idea about use of $KMnO_4$, $K_2Cr_2O_7$as oxidants in acidic medium in redox titrations. Use of I_2 in iodometry and iodimetry. Redox indicators-external and internal indicators. Use of starch as an indicator. Iodometric estimation of Cu (II). **[8]**

B] Gravimetric Analysis:

Definition. Theoretical principles underlying various steps involved in gravimetric analysis with reference to estimation of barium as barium sulphate. Coprecipitation and post precipitation. (Definition, types and factors affecting). **[6]**

Unit III 14L

A] Aldehydes and Ketones:

Preparation of acetaldehyde from ethanol, ethylidene chloride and acetylene. Preparation of benzaldehyde from benzene (Gattermann-Koch reaction) and toluene. Preparation of acetone from isopropyl alcohol, isopropylidene chloride and propyne. Preparation of acetophenone from benzene and ethyl benzene. Structure of carbonyl group, acidity of á-hydrogen in carbonyl compounds. Reactions of aldehydes &/or ketones: Cannizaroôs, Reformatsky, Perkin with mechanism, Mannich reaction, Benzoin and Aldol condensations. Clemmensen, Wolf-Kishner, MPV and $LiAlH_4$ reductions. **[8]**

B] Carboxylic acids:

Structure and reactivity of carboxylic groups. Acidity of carboxylic acids, effects of substituents on acids strength. Oxalic acid: Preparation from ethylene glycol and cyanogen. Reactions: Reaction with ethyl alcohol, ammonia, glycerol and action of heat.

Lactic acid: Preparation from acetaldehyde and pyruvic acid. Reactions: Reaction with ethanol,PCl_5, action of heat, oxidation and reduction. Benzoic acid: Preparation from toluene, benzyl alcohol, phenyl cyanide and benzamide. Reactions : Reaction with ethanol, PCl_5 and ammonia. Salicylic acid: Preparation by Reimer-Tiemann reaction. Reactions: Reaction with CH_3COCl, CH_3OH and C_6H_5OH. **[6]**

Unit IV 14L

A] Optical isomerism:

Element of symmetry, chirality, asymetric carbon atom, enantiomers, diastereoisomers, relative and absolute configurations, DL and RS nomenclature, racemisation and resolution (by chemical method). **[4]**

B] Geometrical isomerism:

Cis-trans & *E-Z* nomenclature, Methods of structure determination. **[3]**

C] Conformational isomerism:

Bayerôs Strain theory and its limitations. Stability of cycloalkanes, conformational isomers of ethane, n-butane and cyclohexane, their energy level diagrams. Newman & Sawhorse projection formulae. **[7]**

Unit V **14L**

A] Thermodynamics and Equillibrium: **[10]**

(i) Gibbôs and Helmholtzôs free energy function. Physical significance of Gibbôs free energy, Change in free energy as a criteria of spontaneity and equilibrium. Variation of free energy G with P & T. Gibbôs-Helmholtzôs equation in terms of G and its application. (ii) Partial molal function, chemical potential, derivations of Gibbôs-Duhem equation. Chemical potential of an ideal gas in gaseous mixture. Derivation of vant Hoffôs isotherm and its application to equilibrium state. Derivation of vant Hoffôs equation and its applications. (iii) Numericals.

B] Phase Equillibrium: **[4]**

(i) Immiscible liquids, Nerst distribution law and its application to association and dissociation of solute in one of the solvent. Process of extraction, derivation of formula for the amount of solute left unextracted after n^{th} extraction. (ii) Phase transition - Clausius-Clyperon equation (only qualitative statement). (iii) Partially miscible liquids - Phase diagram of phenol-water, triethyl amine - water and nicotine-water systems. (iv) Numericals.

Unit VI **14L**

A] Liquid state: **[4]**

(i) Surface tension, determination and its S.I. Unit. Effect of temperature on surface tension, derivation of expression for relative surface tension by Drop number method. Application of surface tension. (ii) Viscosity, determination and its S.I. Unit. Effect of temperature on viscosity, derivation of expression for relative viscosity by Ostwaldôs viscometer method. Applications of viscosity.

B] Electrochemistry: **[10]**

(i) Conductance of electrolyte solution. Specific, equivalent and molar conductance. Determination of conductance of electrolyte solution, variation of specific and equivalent conductance with dilution for strong electrolyte. Conductometric titrations. Applications of conductometric titration. (ii) Migration of ions under the influence of electric field. Transport number of ions. Determination of transport number by Hottorfôs method and Moving boundary method (iii) Kohlrauschôs law of independent migration of ions. Determination of l_{∞} and degree of dissociation a of a weak electrolyte. Determination of dissociation constant of weak electrolyte. (iv) Numericals.

Semester- III

3S Chemistry Practicals

Total Laboratory sessions: 26 **Marks: 50**

Exercise I:

a) Volumetric Analysis

(Standard solutions to be prepared by students only)

16 Laboratory sessions

1) Prepare 0.1N oxalic acid standard solution and find out the acid neutralizing capacity of an antacid using NaOH as an intermediate solution.
2) Prepare 0.1N H_2SO_4 solution and find out its exact normality using NaOH as an intermediate solution and 0.1N oxalic acid as standard solution.
3) To determine the strength of oxalic acid by titration with $KMnO_4$.
4) To determine percentage purity of Ferrous Ammonium Sulphate (FAS) by titration with $KMnO_4$.
5) To determine strength of FAS by titration with $K_2Cr_2O_7$ using internal indicator.
6) To determine strength of $K_2Cr_2O_7$ by titration with FAS using internal indicator.
7) Estimation of copper (II) in commercial copper sulphate sample by iodometric titration.

b) Gravimetric Analysis

Estimation of Ba^{2+} as $BaSO_4$, Fe^{3+} as Fe_2O_3 using china and silica crucible and Ni^{2+} as Ni-DMG using sintered glass crucible.

Exercise II: Physical Chemistry experiments

10 Laboratory sessions

1) To determine refractive index by Abbeôs refractometer.
2) To construct phase diagram of phenol-water system and to determine consolute temperature for the system.
3) To determine transition temperature of $MnCl_2.4H_2O$.
4) To study kinetics of hydrolysis of methyl acetate catalyzed by acid.
5) To study kinetics of saponification of ethyl acetate by NaOH. (Equal concentration)
6) To determine partition coefficient of benzoic acid between benzene and water.

7) To determine partition coefficient of iodine between CCl_4/Kerosene and water.
8) To determine solubility of benzoic acid at different temperature and heat of solution.

Distribution of Marks for Practical Examination

Time: 6 hours (One Day Examination) **Marks: 50**

Exercise-I	**…….. 18**
Exercise-II	**…….. 18**
Viva-Voce	**…….. 07**
Record	**…….. 07**
	Total : 50

B.Sc.Part-II, Semester-IV
4S Chemistry

Total Lectures: 84 ***Marks: 80***

Note: Figures to the right hand side indicate number of lectures.

Unit I **14L**

A] Chemistry of elements of transition series: **[11]**

Definition of transition elements. General characteristics of transition elements. Comparative study of first transition series elements (3d) with reference to following properties: (i) Electronic configuration (ii) Atomic and ionic size (iii) Ionization energy (iv) Metallic nature (v) Oxidation states (vi) Magnetic properties (vii) Color of salts (viii) Catalytic properties (ix) Complex formation behaviour. Study of 4d and 5d series elements-Electronic configuration. Comparison of 3d series elements with 4d and 5d series elements with respect to size, oxidation states, magnetic properties and color.

B] Extraction of elements: **[3]**

Principles involved in extraction of elements. Major methods of extraction of elements. Factors affecting choice of extraction method. Thermodynamics of reduction processes-Ellingham diagrams for oxides and importance of this diagram (only preliminary ideas).

Unit II **14L**

A] Inner transition elements:

Definition, Lanthanides and Actinides. Comparative study of Lanthanides with respect to following properties:(i) Electronic configuration (ii) Atomic and ionic radii lanthanide contraction-definition, cause and effect of lanthanide contraction (iii) Oxidation states (iv) Magnetic properties (v) Color of salts (vi) Complex formation behavior. Occurrence of lanthanides. Isolation of lanthanides by ion exchange method. Actinides- Electronic configuration and oxidation states. Comparison of lanthanides and actinides. **[11]**

B] General Principles of Metallurgy:

Definition of metallurgy, steps in metallurgy. Ore dressing by gravity separation, froath floatation and electromagnetic separation. Calcination, roasting, smelting and refining of metals. Meaning of termshydrometallurgy and pyrometallurgy. **[3]**

Unit III **14L**

A] Polynuclear hydrocarbons:

Naphthalene - Haworth synthesis,orbital picture, Reactions ï electrophilic substitution (orientation) Preparation of naphthols from naphthalene sulphonic acids and naphthylamines from naphthols. [**4]**

B] Reactive methylene compounds:

Malonic Ester: Synthesis from acetic acid, Synthetic applications- Synthesis of acetic acid , succinic acid, glutaric acid, crotonic acid and malonyl urea. Acetoacetic ester: Synthesis from ethyl acetate, Synthetic applications- Synthesis of acetic acid, propionic acid, isobutyric acid, succinic acid, glutaric acid, crotonic acid, acetyl acetone and 4-methyl uracil. **[6]**

C] Carbohydrates:

Constitution of glucose, cyclic structure, Pyranose and Furanose structure, Epimerization, conversion of glucose to fructose and vice-versa, Introduction to fructose, ribose, 2-deoxyribose, maltose, sucrose. (their structures only-determination not needed). **[4]**

Unit IV **14L**

A] Aromatic nitro compounds:

Nitrobenzene: Synthesis from benzene, Reduction of nitrobenzene in acidic, neutral and alkaline medium. **[3]**

B] Amino Compounds:

Basicity and effect of substituents. Methods of preparation of aniline from nitrobenzene, Reactions: with acetyl and benzoyl chlorides, Br_2(aq) and $Br_2(CS_2)$, Carbylamine reaction, alkylation,Hoffmannôs exhaustive methylation and its mechanism. **[4]**

C] Diazonium Salts:

Preparation benzene diazonium chloride, Synthetic applications- Preparation of benzene,phenol, halobenzene,nitrobenzene,benzonitrile, coupling with phenol and aniline. **[3]**

D] Amino acids and Proteins:

Classification, Strecker and Gabrial phthalimide synthesis, Zwitterion structure, Isoelectric point, peptide synthesis, Structure determination of polypeptides by end group analysis. **[4]**

Unit V - Colligative Properties of Dilute Solutions: 14L

(i) Defination and examples of colligative properties.(ii) Elevation of boiling point, thermodynamic derivation of the relationship between elevation of boiling point and molar mass of a non-volatile solute. Cotrellôs method for determination of elevation of boiling point. (iii) Depression of freezing point, thermodynamic derivation of the relationship between depression of freezing point and molar mass of a non-volatile solute. Rastôs method for determination of depression of freezing point. (iv) Abnormal behavior of solution. Vanôt Hoffôs factor óiô. Determination of degree of association and dissociation from Vanôt Hoffôs factor.(v) Numericals.

Unit VI- Crystalline state **14L**

Symmetry in crystal, plane of symmetry, axis of symmetry and point of symmetry. Law of constancy of interfacial angles. Elements of symmetry in cubic crystals. Laws of symmetry. Law of rational indices, Weiss and Miller indices of a lattice planes,

calculation of interplaner distance d(h,k,l) from Miller indices in a cubic system. Seven crystal systems and fourteen Bravais lattices, Bravais lattices of cubic system. Simple cubic system (S.C.C.), body centered cubic system (B.C.C.) and face centered cubic system (F.C.C.). Calculation of number of constituent units in S.C.C., B.C.C. and F.C.C. Ratio of interplaner distances for 100, 110 and 111 lattice plane in S.C.C., B.C.C. and F.C.C. (No geometrical derivation). Derivation of Braggôs equation for X-ray diffraction, Braggôs X-ray spectrometer method for the determination of crystal structure of NaCl and KCl. Anomalous behaviour of KCl towards X-ray. Numericals.

Semester- IV
4S Chemistry Practicals

Total Laboratory sessions: 26 **Marks: 50**

Exercise I: Inorganic estimations **14 Laboratory sessions**

1) Chromatographic separation of binary mixture containing Cu(II), Co(II) and Ni(II) ions by paper chromatography and determination of R_f values.
2) Estimation of Zn(II) by complexometric titration.
3) To determine the strength of unknown calcium salt solution by complexometric titration.
4) Estimation of hardness of water by complexometric titration.
5) Colorimetric or spectrophotometric estimation of Cu(II) in commercial copper sulphate sample as ammonia complex.
6) To determination of concentration of unknown $KMnO_4$ solution from standard solutions of $KMnO_4$ by colorimetrically or spectrophotometrically.

Exercise II: Organic Chemistry Practicals 12 Laboratory Sessions

1. Isolation of casein from milk.
2. Isolation of nicotine from tobacco leaves.
3. Isolation of caffine from tea leaves.
4. Isolation of lycopene from tomato juice.
5. Estimation of glucose.
6. Estimation of acetamide.
7. Determination of equivalent weight of an organic acid.

Distribution of Marks for Practical Examination

Time: 6 hours (One Day Examination)

Marks: 50

Exercise-I	é é é ..	18
Exercise-II	é é é ..	18
Viva-Voce	.é é é .	07
Record	-é é é .	07
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	Total:	50

Books Recommended: (Common for Semester III and Semester IV)

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia- S. Naginchand & Co., Delhi.
2. Text book of Inorganic Chemistry by A.K. De, Wiley East Ltd.
3. Selected Topics in Inorganic Chemistry by Malik, Tuli and Madan- S. Chand & Co.
4. Modern Inorganic Chemistry by R.C. Agrawal, Kitab Mahal.
5. Instrumental Methods of analysis by Chatwal and Anand, Himalaya Publishing House.
6. Concise Inorganic Chemistry by J.D. Lee, ELBS.
7. Inorganic Chemistry by J.E. Huheey- Harper & Row.
8. Fundamental concepts of Inorganic Chemistry by E.S. Gilreath, McGraw Hill book Co.
9. Modern Inorganic Chemistry by W.L. Jolly, McGraw Hill Int.
10. Chemistry Facts, Patterns & Principles by Kneen, Rogers and Simpson, ELBS.
11. Theoretical Principles of Inorganic Chemistry by G.S. Manku, Tata McGraw Hill.
12. Inorganic complex compounds by Murmann, Chapman & Hall.
13. Text book of Inorganic Chemistry by K.N. Upadhyaya, Vikas Publishing House, Delhi.
14. Advanced Practical Inorganic Chemistry by Gurdeep Raj, Goel Pulishing House, Meerut.
15. Co-ordination Chemistry by D. Banerjee, TMH Publication.
16. Text book of Inorganic Chemistry by Nema, Agrawal, Solanki, Morkhade, Meshram, Berad.
17. Text book of Inorganic Chemistry by Bhadange, Pagariya, Deshmukh, Joshi, Bombatkar, Mandlik, Bokey Prakashan, Amravati.

18. Organic Chemistry by R.T. Morrison & R.T. Boyd, 6th edition, PHI.
19. Organic Chemistry by Pine, 5th edition.
20. Organic Chemistry Vol. I, II and III by Mukharjee, Singh and Kapoor- Wiley Eastern.
21. Organic Chemistry by S.K. Ghosh.
22. Reaction Mechanism in Organic Chemistry by S.M. Mukharjee and S.P. Singh.
23. Spectroscopy of Organic Compounds by P.S. Kalsi.
24. Stereochemistry and mechanism through solved problems by P.S. Kalsi.
25. Organic Chemistry by TWG Solomons, 4th edition, John Wiley.
26. Hand Book of Organic Analysis by H.J. Clarke, Arnold Heinmen.
27. Text book of Practical Organic Chemistry by A. I. Vogel.
28. Text book of Organic Chemistry by Wadodkar, Raut, Dighade, Thakre, Kale, Kadu, Chincholkar.
29. Text book of Organic Chemistry by P.S. Kalsi published by Macmilllan India Ltd., 1999, Delhi.
30. Practical Organic Chemistry by F.G. Mann, B.C. Saunders, Orient Longman.
31. Comparative Practical Organic Chemistry (Qualitative Analysis) by V.K. Ahluwalia and Sunita Dhingra, Orient Longman.
32. Comprehensive Practical Organic Chemistry (Preparation and Qualitative Analysis) by V.K. Ahluwalia and Renu Agrawal, Orient Longman.
33. Text book of Organic Chemistry by Deshmukh, Awinashe, Tayade, Wadekar, Meshram, Parhate, Bokey Prakashan, Amravati.
34. Physical Chemistry: Walter, J. Moore, 5th edn., New Delhi.
35. Physical Chemistry: G.M. Barrow, McGraw Hill, Indian Edn.
36. Principles of Physical Chemistry: Maron and Prutton.
37. Principles of Physical Chemistry: Puri, Sharma and Pathaniya.
38. Physical Chemistry: P.W. Atkins, 4th Edn.
39. Text book of Physical Chemistry: P.L. Sony, O.P. Dharma.
40. Physical Chemistry: Levine.
41. Practical Physical Chemistry: Palit and De.
42. Practical Physical Chemistry: Yadao.
43. Practical Physical Chemistry: Khosla.
44. Laboratory Mannual of Physical Chemistry: W.J. Popiel.
45. Practical Chemistry: Dr. S.B. Lohiya, Bajaj publication, Amravati.
46. Text book of Physical Chemistry: Satpute, Kabra, Raghuwanshi, Wankhade, Jumle and Murarka.

47. Text book of Chemistry, B.Sc.-II, Third Semester & Fourth Semester, Nabh Prakashan.

List of equipments/apparatus required for the Chemistry Practicals for B.Sc.

1. Abbeôs Refractometer		02 nos./batch
2. Viscometer		10 nos./batch
3. Stalagmometer		10 nos./batch
4. Melting Point Apparatus		10 nos./batch
5. Thermometer 0-360°C		20 nos./batch
6. Thermometer 0-110°C		20 nos./batch
7. Analytical balance		15 nos./batch
8. Weight box		15 nos./batch
9. Density Bottles		20 nos./batch
10. Kippôs Apparatus		02 nos./batch
11. Quick fit Distillation Assembly/ Multipurpose assembly		10 nos./batch
12. Sintered Glass Crucible		20 nos./batch
13. Silica Crucible		20 nos./batch
14. Vacuum Suction Pump		02 nos./lab.
15. Potentiometer		02 nos./batch
16. Metzer Electronic one pan balance		01 nos./lab.
17. Filtration flask with Buckner Funnels	100ml	10 nos./batch
	250ml	05 nos./batch
	500ml	02 nos./batch
18. Desiccators		10 nos./batch
19. Magnetic Stirrer		10 nos./batch
20. Water Suction		10 nos./batch
21. Conductometer with Conductivity Cell		04 nos./batch
22. Colorimeter		02 nos./batch
23. pH Meter		02 nos./batch
24. Chromatographic Jar		05 nos./batch
25. Separating funnels 250ml, 500ml		05 nos./batch
26. Hot Air Oven		02 nos./lab.
27. Hot-Cold Air Blower		01 no./lab.
28. Centrifuge machine (Electrically Operated)		02 nos./lab.
29. Deioniser/ Water Still (Electrically Operated)		01 no./lab.
30. Hot Plate/ Heating Mantle		05 nos./batch
31. Models of Elements (Seven Crystal types and their symmetry)		01 no./batch

32. Flame Photometer	02 nos./batch
33. Spectrophotometer	02 nos./batch
34. Shaking Machine	01 no./batch
35. Polarimeter	02 nos./batch

4. INDUSTIRAL CHEMISTRY (REGULAR/VOCATIONAL)

The examination in Industrial Chemistry (Regular/ Vocational) of Third semester shall comprise of one theory paper, internal assessment and practical examination. Theory paper will be of 3 Hrs. duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of 6 to 8 hours duration and carry 50 marks.

The following syllabi is prescribed on the basis of six lectures per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question in every unit with internal choice for each of 12 marks & one compulsory question covering all the syllabus of Semester-III (8 marks).

3S Industrial Chemistry (Regular/ Vocational)
Unit Processes and Process Equipments

Total Lectures: 84 **Marks: 80**

Note: Figures to the right hand side indicate number of lectures.

Unit I **[14]**

A) Nitration ï Introduction, nitrating agents, nitration of i) Benzene to nitrobenzene and m-dinitrobenzene. ii) Chlorobenzene to *o* and *p*- nitrochlorobenzenes. iii) Acetanilide to p-nitroacetanilide. Contineous and batch nitration.

B) Amination by Reduction – Introduction, methods of reduction, Bechamp. Reduction (Iron and Acid Reduction), sulphide reduction, alkali sulphite reduction, metal hydrides, cathodic reduction. Factors affecting amination. Manufacturing of aniline, m-nitroaniline, p-aminophenol.

C) Alkylation – Introduction, alkylating agents, mechanism of alkylation. Manufacturing of alkyabenzene, ethylbenzene.

Unit II **[14]**

A) Sulphonation – Introduction, sulphonating agents, factors affecting sulphonation. Sulphonation of benzene, naphthalein. Batch and Contineous sulphonation.