

SANT GADGE BABA AMRAVATI UNIVERSITY

GRADE CARD CUM SEMESTER PERFORMANCE REPORT

NAME OF EXAM: M. SC. (CHEMISTRY) SEMESTER-II (CBCS) Summer 2017

NO. E 0022666

ROLL NO.	NAME OF THE CANDIDATE	ENROLMENT NO.	CENTRE NO.	COLLEGE NO.	MEDIUM	CATEGORY									
78809	KU DIPALI GOPIKISAN CHANDAK	10203565	203	0 203	ENG	0									
SUBJECT/ COURSE CODE & NAME		Maximum Marks				SUBJECT CREDITS			Marks Obtained				GRADE OBTAINED		Exemption
		THEORY	INT	PRACT	INT	THEORY	INT	PRACT	THEORY	INT	PRACT	INT	THEORY + INT	PRACT + INT	
2111 Co-ordination Chemistry		80	20			4	1		01	18			F		P
2112 Organic Chemistry-II		80	20			4	1		03	18			F		P
2113 Physical Chemistry-II		80	20			4	1		24	18			DD		F
2114 Optical Methods & Environmental Chemistry		80	20			4	1		13	17			F		P
3003 Lab-III				100				3			88			AB	F
3004 Lab-IV				100				3			90			AA	F
Total Incentive Marks	Exams Particulars	Credits Accumulated		SGPA	Grade for SGPA	Result	CGPA	Remarks/ Grand Total of Core & Elective Credits					Division		
		Core & Elective	GIC												
Total Incentive Balanced	Total	11	0	2.96				WITH EXEMPTION							
							Grade for CGPA								

NOTE: F = FULL T = THEORY P = PRACTICAL INT = INTERNAL ASSESSMENT AA (shown in Marks Obtained Column) = Absent
 Please see overleaf for details of grading system
 (THIS STATEMENT IS SUBJECT TO CORRECTIONS, IF ANY) @ = Passes by incentive marks vide Ordinance No. 1 Of 85
 * = Passes by Grace Marks vide Ordinance No. 18 Of 2001

DATE: 24/07/17

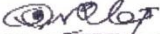

 CONTROLLER OF EXAMINATIONS
 SANT GADGE BABA AMRAVATI UNIVERSITY

TABLE-I Grade Points for Theory and Practical

Grade	Range of Marks obtained out of 100 or Equivalent Fraction	Grade points
AA	90-100	10
AB	80-89	9
BB	70-79	8
BC	60-69	7
CC	55-59	6
CD	50-54	5
DD	40-49	4
F	BELOW 40	0

TABLE-II : Final Grade Points for SGPA and CGPA

Range of Marks obtained out of 100 or Equivalent Fraction	Final Grade
9.00 - 10.00	AA
8.00 - 8.99	AB
7.00 - 7.99	BB
6.00 - 6.99	BC
5.50 - 5.99	CC
5.00 - 5.49	CD
4.00 - 4.99	DD

Note: SGPA & CGPA are awarded on the Basis of Grade Points obtained in Core & Elective courses of the subjects.

TABLE-III Equivalence of Class / Division to CGPA

Sr. No.	CGPA	Class / Division
1.	8.00 or more	First Class-Exemplary
2.	7.50 or more but less than 8.00	First Class with Distinction
3.	6.00 or more but less than 7.50	First Class
4.	5.50 or more but less than 6.00	Higher Second Class
5.	4.00 or more but less than 5.50	Second Class
6.	Less than 4.00	Fail

Computation of SGPA & CGPA

Every student will be awarded points out of maximum 10 points in each subject (based on 7 Points Scale). Based on the Grade points obtained in each subject the Semester Grade Point Average (SGPA) and then Cumulative Grade Point Average (CGPA) are computed. The computation of SGPA & CGPA, is as under:

Semester Grade Points Average (SGPA) is the weighted average of points obtained by a student in a semester and is computed as follows:

$$SGPA = \frac{U_1 \times M_1 + U_2 \times M_2 + \dots + U_n \times M_n}{U_1 + U_2 + \dots + U_n}$$

Where U₁, U₂,.....are subject credit of the respective course and M₁, M₂,.....are the Grade Points obtained in the respective subject (out of 10)

The Semester Grade Point Average (SGPA) for all the four semesters is also mentioned at the end of every semester.

The Cumulative Grade Point Average (CGPA) IS used to describe the overall performance of a student in the course and is computed as under:

$$CGPA = \frac{\sum_{n=1}^4 SGPA(n) C_n}{\sum_{n=1}^4 C_n}$$

Where SGPA (n) if the nth semester SGPA of the student and C_n is the nth semester total credit. The SGPA and SGPA and CGPA are rounded off to the second place of decimal.

Formula for converting CGPA into percentage

$$\frac{CGPA \text{ obtained}}{\text{maximum Grade point}} \times 100$$

SANT GADGE BABA AMRAVATI UNIVERSITY

GRADE CARD CUM SEMESTER PERFORMANCE REPORT

NAME OF EXAM : **M. SC. (CHEMISTRY) SEMESTER-IV (CBCS) Summer 2017**

NO. E0009142

ROLL NO.	NAME OF THE CANDIDATE	ENROLMENT NO.	CENTRE NO.	COLLEGE NO.	MEDIUM	CATEGORY								
83103	KU VRUNDA SANJAYRAO DHARMALE	12203634	203	0 203	ENG	0								
SUBJECT/ COURSE CODE & NAME		Maximum Marks			SUBJECT CREDITS			Marks Obtained				GRADE OBTAINED		Exemption
		THEORY	INT	PRACT	THEORY	INT	PRACT	THEORY	INT	PRACT	INT	THEORY + INT	PRACT + INT	
2141	Spectroscopy-II	80	20		4	1		AA	17			F		P
2142	General Analytical Chemistry	80	20		4	1		AA	17			F		P
2145	Organic Chemistry(Organic Synthesis-II)	80	20		4	1		AA	18			F		P
2146	Organic Chemistry (Natural Product-II)	80	20		4	1		AA	17			F		P
3007	Lab-VII	100			3				84			AB		F
3008	Project	100			3				85			AB		F
Total Incentive Marks	Exams Particulars	Credits Accumulated		SGPA	Grade for SGPA	Result	CGPA	Remarks/				Division		
		Core & Elective	GIC					Grand Total of Core & Elective Credits						
Total Incentive Balanced	Semester-I	26	0				0.00	WITH EXEMPTION						
	Semester-II	26	0											
	Semester-III	26	0			FAIL	Grade for CGPA	Min/Obt+GIS- 104 / 84 84						
	Semester-IV	6	0	2.08										

NOTE: F = FULL T = THEORY P = PRACTICAL INT = INTERNAL ASSESSMENT AA (shown in Marks Obtained Column) = Absent
Please see overleaf for details of grading system
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* = Passes by Grace Marks vide Ordinance No. 18 Of 2001

CONTROLLER OF EXAMINATIONS

TABLE-I Grade Points for Theory and Practical

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AB	80-89	9
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CD	50-54	5
DD	40-49	4
F	BELOW 40	0

TABLE-II : Final Grade Points for SGPA and CGPA

Range of Marks obtained out of 100 or Equivalent Fraction	Final Grade
9.00 - 10.00	AA
8.00 - 8.99	AB
7.00 - 7.99	BB
6.00 - 6.99	BC
5.50 - 5.99	CC
5.00 - 5.49	CD
4.00 - 4.99	DD

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6.	Less than 4.00	Fail

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Where U₁, U₂,.....are subject credit of the respective course and M₁, M₂,.....are the Grade Points obtained in the respective subject (out of 10)

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Where SGPA (n) if the nth semester SGPA of the student and C_n is the nth semester total credit. The SGPA and CGPA are rounded off to the second place of decimal.

Formula for converting CGPA into percentage

$$\frac{CGPA \text{ obtained}}{\text{maximum Grade point}} \times 100$$

SANT GADGE BABA



AMRAVATI UNIVERSITY

GRADE CARD CUM SEMESTER PERFORMANCE REPORT

NAME OF EXAM: M. SC. (CHEMISTRY) SEMESTER-I (CBCS) (NEW) Winter 2019

NO. A 0041275

ROLL NO.	NAME OF THE CANDIDATE					ENROLMENT NO.			CENTRE NO.		COLLEGE NO.		MEDIUM		CATEGORY					
12337	KU RADHA NAGORAO RECHE					15107558			203		0 203		ENG		0					
SUBJECT/ COURSE CODE & NAME						Maximum Marks				SUBJECT CREDITS			Marks Obtained				GRADE OBTAINED		Exemption	
						THEORY	INT	PRACT	INT	THEORY	INT	PRACT	THEORY	INT	PRACT	INT	THEORY = INT	PRACT = INT		
2101 Inorganic Chemistry 2102 Organic Chemistry-I 2103 Physical Chemistry-I 2104 Modern Methods Of Separation 3001 Lab-I 3002 Lab-II						80	20			4	1		AA	15			F		P	
						80	20			4	1		AA	16			F		P	
						80	20			4	1		AA	15			F		P	
						80	20			4	1		AA	15			F		P	
								100				3			AA					
								100				3			AA					
Total Incentive Marks	Exam Particulars	Credits Accumulated		SGPA	Grade for SGPA	Result	CGPA		Remarks/ Grand Total of Core & Elective Credits				Division							
		Core & Elective	GIC																	
Total Incentive Balanced	Total	0	0	0.00					WITH EXEMPTION											
							Grade for CGPA													

NOTE: F=FULL T=THEORY P=PRACTICAL INT=INTERNAL ASSESSMENT AA (Shown in Marks Obtained Column)= ABSENT
 (Please see overleaf for details of Grading System)
 (THIS STATEMENT IS SUBJECT TO CORRECTIONS, IF ANY) * = Passed by University Marks vide Ordinance No. 1 Of 85
 DATE: 14-01-2020 * = Passed by Grade Marks vide Ordinance No. 12 Of 2001

TABLE-I Grade Points for Theory and Practical

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Formula for converting CGPA into percentage

$$\frac{CGPA \text{ obtained}}{\text{maximum Grade point}} \times 100$$

Semester I
Organic Chemistry Practical-I *lab-1*
Total Hours: 90 hrs. (9 Hours per week) Marks: 100

Unit-I Organic Synthesis
Student is expected to carry out minimum of 8-10 organic preparation (involving two steps) from the following lists.
1. Preparation of Benzanilide from Benzophenone.
2. Preparation of p- nitroaniline from Acetanilide.
3. Preparation of p-Bromoaniline from Acetanilide.
4. Preparation of m-nitroaniline from Nitrobenzene.
5. Preparation of p-Chlorotoulene from p-Toluidine.
6. Preparation of p- nitrobenzoic acid from p-Nitrotoulene.
7. Cannizzaro's reaction with 4-Cholobenzaldehyde as a substrate.
8. Preparation of 2-Phenylindole (Fischer-Indole synthesis).
9. Claisen – Schmidt: Dibenzal acetone from benzaldehyde.
10. Preparation of Anthranilic acid. (Hoffman's bromamide reaction).
11. Diels –Alder reaction: Anthracene + Maleic anhydride.
12. Methyl –orange from Sulphanilic acid.
13. Hydroquinone to 2,5-Dihydroxyacetophenone.
14. Chlorobenzene to 2,4- Dinitrophenylhydrazine.
15. Nitrobenzene to p- Aminophenol.

UNIT-II Quantitative Analysis
Student is expected to carry out following estimations (minimum 6 estimations.)
1. Estimation of Vitamin "C" Iodometry.
2. Estimation of Phenol by KBrO₃-KBr.
3. Estimation of Amine by Bromate/ Bromide solution.
4. Estimation of Formaldehyde by Iodometry.
5. Estimation of Glucose by Benedict's solution.
6. Estimation of given carbonyl compound by hydrazone formation.
7. Estimation of Aldehyde by Oxidation method.
8. Determination of percentage of number of hydroxyl group in an organic compound by acetylation method.

Practical-I
Organic Chemistry
Time : 6-8 Hrs. (One day Examination) Marks : 100
(1) Exercise-1 (Organic Synthesis) - 40 Marks
(2) Exercise-2 (Qualitative Analysis) - 40 Marks

Syllabus for Semester II
Paper V
Co-ordination Chemistry
60hrs (4hrs/week). 12hrs/unit 50 Marks

7) To determine equivalence conductance of strong electrolytes at several concentrations and verification of Debye-Huckel Onsagar principle conductometrically.
8) Determination of solubility and solubility product of sparingly soluble salts, e.g., BaSO₄ conductometrically.
9) To find out composition of ferric ion thiocyanate/Nickel and o-phenanthroline complex by Job's method by colorimetrically
10) To study the complex formation between ferric and salicylic acid and find the formula and stability constant of the complex colorimetrically.
11) To determine the dissociation constant of phenolphthalein colorimetrically
12) To determine the dissociation constant of Cu (II) and Fe (III) solution photometrically by titrating it with EDTA

Practical-II *lab-2*
Physical Chemistry
Time : 6-8 Hrs. (One day Examination) Marks : 100
(1) Exercise-1 (Instrumental) - 40 Marks
(2) Exercise-2 (Non-Instrumental) - 40 Marks
(3) Record - 10 Marks
(4) Viva-Voce - 10 Marks

List of Books:-
1. Findley's Practical Physical Chemistry, B.P. Levitt Longman.
2. Practical Physical Chemistry, A.M. James and F.F. Prichard Longman.
3. Experimental Physical Chemistry, R.C. Das and B.Behra, Tata McGrawHill.
4. Advanced Physical Chemistry Experimentals Gurtu-Gurtu Pragati Prakashan
5. Experimental Physical Chemistry, V.D. Athanale and Parul Mathur New age International
6. Advance Practical Physical Chemistry J.B. Yadav Goel Pubs. House.
7. Experimentals in Physical Chemistry by Dr. D.V.Jahagirdhar.
8. Experiments in Physical Chemistry by D.P.Shoemaker.
9. Systematic experimental Physical Chemistry by Dr. T.K. Chandrahekar & S.W. Rajbhoj.

Semester I
Practical II
Physical Chemistry
Total Hours: 90 hrs. 9 Hours per week
Time: 6 – 8 hrs. Marks: 50
Use of Computer Programs 5 terms of practicals :
Treatment of experimental data, X-Y plots, programs with data preferably from physical chemistry practicals. Students will operate two packages I) MS-Word and II) MS-Excel.

Part-A
1) To study the surface tension-concentration relationship for solution and determination of surface excess concentration by using Gibbs' adsorption equation.
2) To find out the molecular surface energy and the association factor of ethyl alcohol.
4) To compare the cleansing power of two samples of detergent by surface tension method.
5) To study the effect of concentration of an electrolyte (KCl, NaCl) on solubility of an organic acid.
6) To study the kinetics of iodine clock reaction.
7) To study the reaction between acetone & iodine in presence of acids.
8) To study the decomposition of hydrogen peroxide catalyzed by iodine ion.

Part-B
1) To measure refractometrically average polarisability of some common solvents.
2) To find out the order of reaction and velocity constant of inversion of cane sugar by acid polarimetrically.
3) Polarimetric determination of the specific rotation of camphor in benzene and carbon tetrachloride.
4) Determine the rate constant, order of reaction and energy of activation of saponification of ethyl acetate by sodium hydroxide conductometrically.
5) To find out degree of dissociation constant of acetic acid and monochloroacetic acid by conductometrically.
6) Determination of strength of strong and weak acid in given mixture conductometrically.

Syllabus for Semester II
Paper V
Co-ordination Chemistry
60hrs (4hrs/week). 12hrs/unit 50 Marks

Unit-I **Ligand field theory (LFT)**, Failure of ionic model of CFT. Experimental evidences in support of metal ligand orbital overlaps, Adjusted crystal field theory (ACFT), Molecular Orbital Theory: Ligand symmetry orbitals, Sigma and pi-molecular orbitals, Qualitative treatment of MOT of Octahedral complexes with sigma bonding and also with sigma and pi bonding, Qualitative MO diagrams and their interpretation of octahedral, tetrahedral and square planar complexes with example. Explanations of charge transfer spectra. Comparison of theories of bonding-VBT, CFT, LFT and MOT.

Unit-II Electronic spectra: 12L
Spin-orbit (L-S) coupling scheme, calculation of spectral term symbols for ground state and excited states, selection rules, vibronic coupling, electronic spectra of transition metal complexes, charge transfer spectra, band intensities, band energies, band width & shapes, construction and application of Orgel diagrams, Tanabe-Sugano diagrams, spectra of octahedral, tetrahedral and square planar complexes with examples, Jahn-Teller effect, calculation of crystal field parameters (10Dq, B, and C) for octahedral Ni (II) and Co(II) complexes from electronic spectra. Spectrochemical series, Nephelauxetic effect and Nephelauxetic series of ligands. Magnetic moment, electronic spectra and structure of complexes.

Unit-III Reaction Mechanism of Transition Metal complexes -I 12L
Reactivity of metal complexes, ligand replacement reaction: classification of mechanism and energy profile of reaction. Inert and labile complexes, interpretation of lability and inertness of transition metal complexes on the basis of VBT and CFT. Factors affecting the lability of a complex, transition state or activated complex, substrate, attacking reagents electrophilic and nucleophilic, Nature of central atom. Kinetic application of CFT. Kinetics of octahedral substitution, acid hydrolysis, factors affecting acid hydrolysis, base hydrolysis, conjugate base mechanism,

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21. Analytical chemistry- Problems and Solution- S. M. Khopkar, New Age.
 22. Environmental Chemistry, J.W. Vanloon, Oxford University Press.

Semester II

Practical III

lab 3

Physical Chemistry

Practical Work load (9Hours/week) Duration: 6Hours Marks : 100

Use of Computer Programs 5 terms of practicals.

Treatment of experimental data, X-Y plots, programs with data preferably from physical chemistry practical. Students will operate two packages I) MS-Word and II) MS-Excel.

Part A

- 1) To find out molecular weight of given liquid by steam distillation method.
- 2) To find out the molecular weight of sulphur, alpha-naphthol and biphenyl by freezing point method using naphthalene as a solvent.
- 3) To find out degree of association of benzoic acid in benzene by cryoscopy method.
- 4) To study the effect of temperature on adsorption.
- 5) To determine the viscosity of different mixture benzene, nitrobenzene and also test the validity of Kendall's method.
- 6) Identify and separate given mixture of amino acid by paper chromatography.
- 7) Separation of metal cations (Co, Ni, Zn, Mn) and the Rf value by paper chromatography.
- 8) Separate and identify sugar present in honey by paper chromatography.
- 10) To check up by TLC technique whether the following ink consist of single or multiple mixtures of dyes.

Part-B:

- 1) Determination of pK value of acid-base indicator (methyl red, methylene blue & bromo cresol) by spectrophotometrically.
- 2) Determination of standard electrode potential of Zinc and Copper.
- 3) To find the strength of HCl and Acetic acid in given mixture potentiometrically.
- 4) To find the strength of mixture of halides by titrating it against AgNO₃ solution potentiometrically.
- 5) To determine the hydrolysis constant of aniline chloride by emf method.
- 6) To determine the solubility and solubility product of a sparingly soluble salt potentiometrically.

Practical-III

Physical Chemistry

Time : 6-8 Hrs. (One day Examination)

Marks : 100

- | | | |
|----------------------------------|---|----------|
| (1) Exercise-1 (Based on Part-A) | - | 40 Marks |
| (2) Exercise-2 (Based on Part-B) | - | 40 Marks |
| (3) Record | - | 10 Marks |
| (4) Viva-Voce | - | 10 Marks |

Semester II

Practical IV

Inorganic Chemistry Practicals

lab 4

Practical Work load 9 Hrs. /Week

Marks 50

- I] Preparation of inorganic compounds and their characterization by elemental analysis, MW determination, decomposition temperatures and molar conductance studies. (Minimum 6)
 1. [VO (acac)₃]
 2. $\text{cis K}[\text{Cr}(\text{C}_2\text{O}_4)_2(\text{H}_2\text{O})_2]$
 3. $\text{Na}[\text{Cr}(\text{NH}_3)_2(\text{SCN})_2]$
 4. $\text{Mn}(\text{acac})_3$
 5. $\text{K}_3[\text{Fe}(\text{C}_2\text{O}_4)_3]$
 6. $\text{Hg}[\text{Co}(\text{SCN})_4]$
 7. $[\text{Co}(\text{Py})_2\text{Cl}_2]$
 8. $\text{TiO}(\text{C}_6\text{H}_5\text{NO}_2)_2(\text{H}_2\text{O})_2$
 9. $\text{cis}[\text{Co}(\text{trine})(\text{NO}_2)_2]\text{Cl}\cdot\text{H}_2\text{O}$
 10. $[\text{Cu}_2(\text{CH}_3\text{COO})_4(\text{H}_2\text{O})_2]$
 11. $\text{K}_3[\text{Al}(\text{C}_2\text{O}_4)_3](\text{H}_2\text{O})_2$
 12. $\text{Ni}(\text{dmg})_2$
- II] A) Quantitative Analysis of mixture of two cations:
Quantitative analysis of binary mixture of cations involving their chemical separation and separate analysis of one cation by gravimetry and another by volumetric or colorimetric. Certain model examples are given below:
 - i) Copper (II) and Nickel (II)
 - ii) Copper (II) and Zinc (II)
 - iii) Nickel (II)—Zinc (II)
 - iv) Copper (II)—Iron (III)
- B) Analysis of Limestone, Dolomite and Bauxite.
- III] Qualitative analysis of radicals
Qualitative analysis of inorganic mixture for a total of five radicals including interfering radicals (not more than one such radical in a mixture), rare earth (not more than two rare earths in a mixture) and combination of cations (minimum 8 mixtures).

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- 7) To determine the heat of reaction, equilibrium constant and other thermodynamic functions for the reaction $\text{Zn} + \text{Cu}^{2+} = \text{Zn}^{2+} + \text{Cu}$ potentiometrically.
- 8) To titrate ferrous ammonium sulphate solution with potassium dichromate solution potentiometrically using bimetallic electrode pair.
- 9) To determine the dipole moment of given liquid.
- 10) To obtain the phase diagram of ethanol-water-benzene system at room temperature.
- 11) To obtain solubility curve for liquid say water-acetic acid-chloroform system.
- 12) Determination of strength of commercial phosphoric acid/Vinegar by conductometric analysis.

Physical Chemistry Practical

Books Suggested :

- 1) Experimental physical chemistry, R.C. Das and B. Behera, Tata McGraw-Hill
- 2) Advanced physical chemistry J.B. yadao, Goel Pub House
- 3) Experiments in physical Chemistry, D.P. Shormaker, C.W. Garland and J.W. Nibler, Tata McGraw Hill Comp.
- 4) Post graduate physical chemistry, Patel, Turakhia, Kelkar, Himalaya Pub House
- 5) Experiments, in physical chemistry, D.v. Jahagirdar, Himalaya Pub House
- 6) Practical Physical Chemistry, A. Findlay Revised by J.A. Kitehner, Longmans , Green
- 7) Experiments in Physical Chemistry, F. Daniels and J. Williams, Mc Graw Hill.
- 8) Systematic Experimental Physical Chemistry, T.K. Chondekar & S.W. Rajbhoj, Anjali Pub. Aurangabad.
- 9) Advanced Physical Chemistry Experiments, J.N. Gurtu & A. Gurtu, Pragati Prakashan
- 10) Practical Physical Chemistry, A.M. James & P.E. Prichard, Longam Group Ltd.
- 11) Experiments in physical Chemistry, J.M. Wilson, K.J. Newcombe, A.R. Denko, and R.M.W. Richett, Pergamon Press,
- 12) Senior Practical Physical Chemistry, B.D. Khosle and V.S. Garg S.Chand & Comp.

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Cations: Mercury (I, II), Pb, Ag, Bi (III), Cu (II), Cd (II), As (IV, V), Sb (IV, V), Sn (II, IV), Fe (III), Al (III), Cr (III), Ni (II), Co (II), Mn (II), Zn (II), Barium, Strontium, Calcium and Magnesium.
Interfering radicals: Phosphate, Oxalate, Fluoride and Borate.
Rare Earth: Ti, Mo, W, Se, Te, Zr, Th, V, U, Ce.

The Practical examination will be based on the Inorganic Chemistry.

Time: 6-8 hours (one day examination)

Marks: 100

- | | | |
|-------------------------------------|---|-------------|
| I) Exercise -1 (Synthesis/Radicals) | - | 40 Marks |
| II) Exercise-2 (Estimation) | - | 40 Marks |
| III) Record | - | 10 Marks |
| IV) Viva- Voce | - | 10 Marks |
| Total | | - 100 Marks |

List of Books-

1. Synthesis and Characterization of Inorganic Compounds, W. L. Jolly, Prentice Hall.
2. Inorganic Experiments, J. Derek Woollins, VCH.
3. Practical Inorganic Chemistry, G. Marrant, B. W. Rockett, Van Nostrand.
4. A Text Book of Quantitative Inorganic Analysis, A. I. Vogel
5. EDTA Titrations. F. Laschka
6. Instrumental Methods of Analysis, Willard, Merit and Dean (CBS, Delhi).
7. Inorganic Synthesis, Jolly
8. Instrumental Methods of Chemical Analysis, Yelri Lalikov
9. Fundamental of Analytical Chemistry, Skoog D.A. & West D.M Holt Rinehart & Winston Inc.
10. Experimental Inorganic Chemistry, W.G.Palmer, Cambridge.

Syllabus for Semester III

Paper IX

Spectroscopy I

60 Hours (Four hours/week)

12 Hrs. / Unit.

Max.Marks.50.

Unit-I

- A) Unifying principle: Electromagnetic radiation, interaction of electromagnetic radiation with matter- absorbance emission, transmission, reflection, refraction, dispersion, polarization and scattering. Uncertainty relation and natural line width and line broadening, transition probabilities, results of the dependent perturbation theory, transition moment, selection rule, intensity of spectral lines. Born-oppenheimer approximate, rotational, vibrational and electronic energy level.

6L

- C) **Evaporation:** Introduction, short tube evaporator, forced circulation evaporator, falling film, climbing film, agitated evaporators.
D) **Filtration:** Introduction, Filter media, filter aids, equipments sparkler filter, sand filters, bag filters, rotary drum filter.
E) **Crystallization:** Introduction, solubility, super-saturation, nucleation, crystal growth, equipments tank crystallizer, Swenson-Walker crystallizer, Oslo crystallizer.
F) **Drying:** Introduction, free moisture, bound moisture, drying curve, equipments: tray dryer, fluid bed dryer, drum dryer, spray dryer.
G) **Extraction:** Introduction, selection of solvent, single stage and multistage extraction, spray column, packed column, mixer settler, centrifugal extractor
- Unit-III : Material Balances: 12 L**
Material balance without chemical reactions, flow diagram, without recycle or by-pass for above processes. Problems based on above.
Material balances involving chemical reactions, Concept of limiting reactant, excess reactant, yield and selectivity, stoichiometric coefficient and stoichiometric equation conversion, purge operation and Problems.
- Unit – IV : 12 L**
A) **Nitration:** Introduction, nitrating agents, equipment for nitration, manufacturing and mechanism of nitrobenzene, Ortho and para nitrochlorobenzene
B) **Amination by reduction:** Introduction, methods of reduction, metal & acid, sulphide reduction, metal & alkali reduction, manufacturing and mechanism of aniline, meta nitro aniline.
C) **Halogenation:** introduction, reagents of halogenation, aromatic halogenation, manufacturing and mechanism of chlorobenzene, dichlorofluoromethane
- Unit – V : 12 L**
A) **Sulphonation:** Introduction, sulphonating agents, factors affecting sulphonation, equipment, manufacturing and mechanism of benzene sulphonic acid, sulphonation of anthraquinone
B) **Oxidation:** introduction, oxidizing agents, vapour & liquid phase oxidation, manufacturing and mechanism of acetic acid, acetaldehyde, benzoic acid
C) **Alkylation:** Introduction, alkylating agents, factors affecting alkylation, manufacturing and mechanism of ethyl benzene, phenyl ethyl alcohol

Books Suggested:

- 1) Heat transfer By Arora and Damkondwar, Pune
- 2) Heat and Mass transfer by A. G. Gavane, Nirali Prakashan, Pune VOL I & II.
- 3) McCabe and Smith, Unit operations of Chemical Engineering, McGraw Hill.
- 4) Budger and Bancharo, Introduction to Chemical Engineering McGraw Hill.
- 5) Text Book of Industrial Chemistry Pragti Agencies Pune.
- 6) Engineering Chemistry By Dr. S. S. Dara.
- 7) Unit Process in Organic Synthesis, by P. H. Groves.
- 8) Shreve s Chemical Process Industries edited by Austin, McGraw-Hill.
- 9) Dryden s outlines of Chemical Technology, edited by M.Gopal Rao and M.Sittig.
- 10) Industrial Chemistry by B.K.Sharma
- 11) Hand book of industrial chemistry Vol I & II K. H. Davis & F.S. Berner Edited by S.C. Bhatia, CBS publishers

**Semester III Paper XII
Special Paper II
Industrial Chemistry (Fuels and Heavy Chemicals)**

60 Hours (4-Hours/week)

80 Marks

12 hours/Unit

- Unit – I : 12 L**
Fuels: Introduction, History of Fuels, History of solid fuel, Definitions and properties of solid fuels, classification of Fuels on the basis of occurrence, physical state, Formation of coal. Coal mining, proximate and ultimate analysis of coal, determination of calorific value by using Bomb calorimeter, Coal tar distillation, problems on calculation of calorific value. ecofriendly fuels, environment aspects.
- Unit – II : 12 L**
Petroleum oils: Introduction, occurrence, composition of petroleum, processing of petroleum, thermal cracking, catalytic cracking, visbreaking, octane rating (octane number), cetane number, knocking, antiknock compounds, flash point, and aniline point, petrochemicals applications, synthetic petroleum.
Lubrication oils:- Properties and uses of refrigeration oils, transformer oils and gear oil. Additives for lubrication oils antioxidant; passivators, pour point depressants, detergents, adhesives and emulsifiers.
- Unit – III : Manufacture of Heavy Chemicals : 12 L**
Chemical processes for the manufacture of Heavy chemicals like- soda ash, bicarbonates, chlorine, caustic soda, bleaching power, calcium carbides, Silicon Carbide, Lime and acids like H_2SO_4 , HCl , HNO_3 , H_3PO_4 and their applications.

Unit-IV :

12 L

A) **Cement:** Types of cement, manufacture- processes (Wet and Dry), setting and Hardening of cement, cement additives.

B) **Glass:** Types, their composition & properties, manufacture of glass, optical glass, coloured glasses, lead glass and neutron absorbing glass.

C) **Ceramics:** Introduction, types, manufacturing process, applications & refractories.

Unit-V : Sugar Industries

12 L

Manufacturing of sugar from sugarcane: Introduction, agriculture, harvesting, preparation of cane for meal, juice extraction, diffusion, juice purification, evaporation, crystallization (production of raw sugar), centrifugation, sugar refining, decolouring, purification, filtration, crystallization grade analysis. Analysis of bagasse and molasses, byproducts of sugar industries.

Books Suggested:

1. Engineering Chemistry By Dr. S. S. Dara.
2. Modern Petroleum Technology by G. D. Hobson and W. Pohl.
3. Petroleum refining and engineering by W. L. Nelson.
4. Petroleum refining technology and economics by J. H. Gary and G. E. Hardwork.
5. The Petroleum chemical industry by Goldstein and Waddams.
6. Petroleum processing handbook by W. E. Bland and R. L. Davidson.
7. The Text book on Petrochemical by Dr. B. K. Bhaskar Rao, Khanna Publishers NewDelhi.
8. Modern Petroleum refining Processes by Dr. B. K. Bhaskar Rao, Oxford, IBH, 1984
9. Petroleum product handbook.
10. Charles E. Dryden, Outline of Chemical Technology Edited by M. Gopal Rao and
11. Marshall Siting, East West press 2nd Edition 1973.
12. Chemical Process Industries by R. N. Shreves and M. J. A. Brink. McGraw Hill Ltd. 4th Edition.
13. Manual of Chemical Technology VOL I & II by Venketeshar Educational Development Center. IIT Madras, 1977.
14. Material science, O. P. Khanna, Khanna Publishers, Delhi

Semester III
Practical V
Inorganic Chemistry Practical

lab-5

Total Hours: 90 hrs. (9 Hours per week) (26 Laboratory Session)

Total Marks: 100

Quantitative Inorganic Analysis:

- 1) Detection and determination of Ascorbic acid from biological sample.
- 2) Determination of Phosphates from plant samples by spectrophotometry.
- 3) Determination of iron from pharmaceutical samples and coordination compounds.
- 4) Determination of Calcium from given drug sample by complexometry.
- 5) Determination of Iron, Calcium and Phosphorus from milk powder.
- 6) Drug Analysis: Aspirin, benzyl benzoate etc.
- 7) Practicals based on food analysis: honey, oil, tea-leaves, turmeric powder etc.
- 8) Analysis of stainless steel (Cr/Ni)
- 9) Determination of Ca content in chalk / milk powder as Ca-oxalate by permagnetometry
- 10) Simultaneous Spectrophotometric determination of-
 - i) Chromium and Manganese
 - ii) Titanium and Vanadium.
 - iii) Cobalt and Chromium
- 11) To determine the stability constant and stoichiometry of Ferric-thiocyanate complex by spectrophotometrically.
- 12) To study the stoichiometry and stability of Fe³⁺ salicylate complex by job's and mole ratio method spectrophotometrically.
- 13) Estimate the amount of copper (II) with EDTA photometric titration
- 14) Determination of capacity of anion and cation exchange resin by column method.
- 15) To estimate the amount of magnesium and zinc in the given sample solution by ion exchange chromatography method.
- 16) Separation and estimation of Fe²⁺, Co²⁺ and Ni²⁺ by anion exchanger.
- 17) Separation and estimation of Halide by anion exchanger.
- 18) Separation and estimation of-
 - i) Cobalt and nickel
 - ii) Calcium and Zinc and
 - iii) Zinc and Magnesium by anion exchange.
- 19) Separation and estimation of Fe³⁺ and Mg²⁺ by solvent extraction
- 20) Solvent extraction by binary mixtures i. e. Al/Mg, Mg/UO₂, Cu/Ni, Cu/Co etc. and quantitative determination by spectrophotometry.
- 21) Nickel / Molybdenum / tungston/vanadium / Uranium etc by extractive spectrometric method.

- 22) Separation, identification and quantitative determination of metal ions by paper chromatography.
- 23) Separation and identification of sugars/ honey/halides by paper chromatography and determination of Rf values
- 24) Thin layer chromatographic separation, identification and determination of Rf values
 - a. Metal ions (Mn, Co, Ni, Cu, Zn, Cd, Pb, alkali metals etc)
 - b. Amino acids/ Organic compounds
 - c. Sulpha drugs in tablets and ointments.
- 25) Estimation of zinc/metals by fluorimetrically.
- 26) Nephelometric determinations of sulphate, phosphate, silver.
- 24) Potentiometric determination of the percentage of sodium carbonate in commercial washing soda.
- 25) Water analysis:
 1. Determination of sodium and potassium by flame photometry.
 2. Determination of hardness, alkalinity, salinity, Chloride, Fluoride, Nitrite, Nitrate, phosphate and Sulphate.
 3. Determination of DO, COD and BOD.
 4. Determination of toxic metals viz As, Cd, Pb, Hg, and Ni in water and wastewater by suitable method.

The Practical examination will be based on the Inorganic Chemistry.

Time: 6-8 hours (one day examination)

Marks: 100

I)	Exercise -1 (Based on Instrumental)	- 40 Marks
II)	Exercise-2 (Based on Separation Method)	- 40 Marks
III)	Record	- 10 Marks
IV)	Viva- Voce	- 10 Marks

Total - 100 Marks

List of Books-

1. Day and Underwood: Quantitative Analysis
2. Vogel A.I: A textbook of quantitative Inorganic analysis, Longman.
3. Flaschka: EDTA Titration
4. Meites and Thomas: Advanced Analytical Chemistry.
5. Ewing, G.W.: Instrumental Methods of Chemical Analysis, McGraw-Hill
6. Drago, R.S: Physical Methods in Inorganic Chemistry
7. Christian G.D.: Analytical Chemistry
8. Khopkar S.M.: Basic Concept of Analytical Chemistry.
9. Kollath and Ligane: Polarography
10. Braun: Instrumental methods of chemical Analysis
11. Willard, Merritt and Dean: Instrumental methods of Chemical Analysis, Van Nostrand
12. Strouts, Crifillan and Wilson: Analytical Chemistry.
13. Skoog S.A. and West D.W.: Fundamental of Analytical Chemistry
14. Dilts R.V.: Analytical Chemistry
15. Jahagirdar D.V.- Experiments in Chemistry
16. Chondhekar T.K.- Systematic Experiments in Physical Chemistry, Rajbong S.W., Anjali Pubn.
17. Wilehov G.J.- Standard methods of Chemical analysis, 6th Ed.
18. Ramesh R & Anbu M, Chemical Methods for Environmental Analysis: Water & Sediment, Macmillan India.

SEMESTER III
Organic Chemistry Practical - VI

lab-6

Total Hours: 90 hrs. (9 Hours per week)

Marks: 100

A- Multistage Preparations. (Total Laboratory Session 14) (45 marks)

- i) Preparation of p-nitroaniline from aniline
- ii) preparation of p-bromo aniline from aniline
- iii) Benzaldehyde → chalcone → chalcone epoxide
- iv) Flavnone
- v) Coumarine
- vii) Fisher Indol Synthesis
- viii) Skrup-Quinoline synthesis
- viii) Synthesis of Carbohydrates (any one)
- ix) Hippuric acid → Azalactone → 4-Benzylidene 2-phenyl oxazol-5-one
- x) Benzophenone → benzopinacol → benzopinacolone
- xi) Benzoin → benzil → benzilic acid (By Green Synthesis)
- xii) Acridone from anthranilic acid

Note: 1. Synthesis is carried out in molar quantities (Less than 2 gm). 2. Reaction with possible mechanism. 3. Calculate Theoretical and practical % yield. 4. Product conformation by Physical constant and TLC. 5. Give expected spectral data (IR and NMR) of starting material, intermediate and final product (Theoretically differences). 6. All the prepared organic compounds should be stored as a sample and present at the time of University examination.

Scheme of Marking:

i)	Synthesis of products of. (each steps)	09
ii)	Yield of the crude product (each steps)	09
iii)	MP of the recrystallized product (each steps)	09
iv)	TLC of the recrystallized product (each steps)	09
v)	Prediction of Spectral data for product of each step	09

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B- Estimations: (07 Laboratory Session)

(20 Marks)

- i) Nitrogen
- ii) Halogen
- iii) Sulphur
- iv) Soxhlet extraction of oil from oil seeds and determination of saponification value, iodine value of the same oil
- v) Soxhlet extraction of piperine from black pepper
- vi) Spectrophotometric/UV estimations of Caffeine.
- vii) Spectrophotometric/UV estimations of Cholesterol.
- viii) Analysis of Lindane in BHC powder
- ix) Analysis of some common pesticides, insecticides, plastics and detergents.

C- Purification of Solvents

(Total Laboratory Session 5)

(15 marks)

**Practical-VI
Organic Chemistry**

Time : 6-8 Hrs. (One day Examination) Marks : 100

- | | |
|---|----------|
| (1) Exercise-1 (Organic Synthesis) - | 45 Marks |
| (2) Exercise-2 (Qualitative Analysis) - | 20 Marks |
| (3) Exercise-3 (Qualitative Analysis) - | 15 Marks |
| (4) Record - | 10 Marks |
| (5) Viva-Voce - | 10 Marks |

Total - 100 Marks

Books Suggested:

- 1) Modern Experimental Organic Chemistry-Royston M. Robert, John C. Gilbert, Lyu B. Rodewald, S.
- 2) Experimental Organic Chemistry- L. M. Harwood, C. I. Moody
- 3) Semi-microqualitative Organic analysis-N. D. Cheronis, J. B. Entrikin, E.M. Wodnett.
- 4) The Systematic identification of Organic compounds-R.L. Shrine, D.Y. Curtin.
- 5) Quantitative Chemical analysis A.I. Vogel.
- 6) Vogel's textbook of quantitative analysis (Revised)-J. Bassett, R.C. Denney, G.H. Jeffery and J.
- 7) Experiment and technique in Organic chemistry-D. Pasto, C. Johnson and M. Miller.
- 8) Hand book of organic analysis qualitative and quantitative-H. Clark, Edward Arnold.

**SEMESTER -IV
Paper XIII SPECTROSCOPY-II**

Total Lectures: 60Hrs, 4 Hrs per week, 12 Hrs/unit

Total Marks-80

- | | |
|---|------------|
| Unit-I : | 12L |
| <p>A) Raman spectroscopy: Classical and quantum theories of raman effects , Normal, Resonance and Laser Raman spectroscopies, Pure rotational and vibrational and vibrational rotational raman spectra, selection rules, mutual exclusion Raman spectroscopy, coherent antistokes Raman spectroscopy (CARS). Applications for the study of active sites of metalloproteins. Structure determination by symmetry selection rules (Normal Coordinate analysis). , Rotational Raman- spectra, Vibrational Raman ,Spectra, polarization of light and Raman effect, structure elucidation from combined Raman and IR spectroscopy, applications in structure elucidation, Application of Raman spectroscopy to structural chemistry.</p> <p>B) Photoelectron spectroscopy: Basic principle, classification of electron microscopy methods ,photoelectric effect, ionization process, Koopmans theorem PES and X-PES, PES spectra of simple molecule, ESCA, chemical information from ESCA. Auger electron spectroscopy-basic idea. Scanning electron microscopy, working of SEM instrument surface characterization by spectroscopy and microscopy, (SEM/TEM). atomic force microscopy(AFM), application AFM, comparison of electron microscopy with electron Inversion photo emission, multi photo ionization, spin resolved photoionization.</p> | |
| Unit-II : | 12L |
| <p>A) X-ray diffraction : Interaction of x-ray with matter, scattering and diffraction. Brags method Debye-Sherrer method of Xray structural analysis of crystals, index reflection, identification of unit cell from systematic absence in diffraction pattern structure of simple lattice and x-ray intensities structure factor , its relation to intensity of electron density procedure for x-ray structure analysis.</p> <p>B) Electron diffraction : Scattering intensity Vs scattering angle, wierl equation, measurement techniques, elucidation of structure of simple gas phase molecules. Low energy electron diffraction and structure of surface.</p> <p>C) Neutron diffraction: Scattering of neutrons by solids and liquids magnetic scattering, measurement techniques. Elucidation of structure of magnetically ordered unit cell.</p> | |
| Unit-III : | 12L |
| <p>Electron Spin Resonance Spectroscopy : Introduction ,basic principle. zero field splitting and Kramer's degeneracy, factors effecting the g values, hyperfine splitting, hyperfine and super hyperfine coupling constants, determination of g values. Instrumentation, working of instruments, sensitivity, concentration, choice of solvent. presentation of ESR spectra, application of ESR to study the free radicals, structure determination, reaction velocities, McConnell relation, application to inorganic compounds including biological system and to inorganic free radicals such as PH4⁺, F2⁻, [BH3]⁻, determination of oxidation state of metals, Eldor and Eldor techniques The EPR of triplet states; Structural applications to transition metal complexes, ESR spectrum when one electron is influenced by a single proton and one electron delocalized over two equivalent protons, difference between ESR and NMR</p> | |

SEMESTER IV
Practical - VII
Organic Chemistry Special

lab-7

Total Hours: 90 hrs. (9 Hours per week) Marks: 100

A- Qualitative Organic Analysis: (40 Marks) (12 Laboratory Session) Separation, purification and identification of ternary (three component) mixtures. The water soluble solid/liquid should also be given. Student should submit the purified samples of the separated compounds and prepare a suitable derivative of the three compounds separated out.

Note : Analysis of at least ten mixtures should be carried out.

Scheme of Marking: Type of the mixture	10
i). Analysis of the individual components: (10 Marks for each component)	
ii). Detection of Elements	02
iii). Detection of functional groups	02
iv). Determination of MP/BP	02
v). Preparation of the derivative	02
vi). Identification (Spotting)	02

B- Spectral Interpretation and use of Chem draw software (Total Laboratory Session 6) (15 marks)

C: Miscellaneous Experiments (Mandatory) (Total Laboratory Session 8) (25 marks)

- (1) Reduction reaction of 3-nitroacetophenone (Stereo selective synthesis)
 - (i) Reduction with Tin and Hydrochloric Acid
 - (ii) Reduction with sodium borohydride
- (2) Grignard Reaction: Conversion of Benzophenone into triphenyl methanol.
- (3) Synthesis of 5,5-Diphenylhydantoin from benzil, as an anticonvulsant.
- (4) Extraction of Limonene (essential oil) from orange by steam Distillation.
- (5) Synthesis of anaesthetic drug Benzocaine.
- (6) Synthesis of anticancer drug 6-methyl uracil.
- (7) Synthesis of α -Acetylaminocinnamic acid from glycine.
- (8) Estimation of blood sugar, calcium, and total nitrogen and non-protein nitrogen in blood.

**Practical-VI
Organic Chemistry**

Time : 6-8 Hrs. (One day Examination) Marks : 100

(1) Exercise-1 (Organic Synthesis) -	40 Marks
(2) Exercise-2 (Qualitative Analysis) -	15 Marks
(3) Exercise-3 (Qualitative Analysis) -	25 Marks
(4) Record -	10 Marks
(5) Viva-Voce -	10 Marks

Total	100 Marks
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Books Suggested:

1. Textbook of practical organic chemistry qualitative and quantitative analysis (Vol I & II)- A.I. Vogel.
2. Elementary practical organic chemistry small scale preparation (Langman)- A.I. Vogel.
3. A handbook of organic analysis.-H.T.Clark.
4. Systematic qualitative organic analysis H. Middleton.
5. Advanced practical organic chemistry-N. K. Vishnoi.
6. Small scale organic preparation-P.J Hill
7. Practical organic chemistry-H. Dupont Durst & George W.Gokal.
8. Experimental organic chemistry Part I & II, P. R. Singh, D. S.Gupta & K.S. Bajpai.
9. Vogel's textbook of practical organic chemistry-A.R. Tatchell

Semester IV
Practical-VII
Physical Chemistry Special

Practical Workload 9 Hrs./week

Time: 6-8 hours

Marks: 100

USE OF COMPUTER PROGRAMES 5 TERMS OF PRACTICALS.

Treatment of experimental data, X-Y plots, programs with data preferably from physical chemistry practical. Students will operate two packages I) MS-Word and II) MS-Excel.

Part-A

- 1) To find out Energy of activation & Temperature coefficient of hydrolysis of methyl / ethyl acetate
- 2) To find out Energy of activation of the reaction between potassium persulphate & potassium iodide.
- 3) **Determination of partial molar volume of solute and solvent in binary mixture.**
- 4) **To study the variation of solubility of calcium sulphate with ionic strength and hence determine thermodynamic solubility product.**
- 5) **To study the adsorption of acetic acid on charcoal and prove the validity of Freundlich and Langmuir adsorption isotherm.**
- 6) To determine the critical micelle concentration of soap.
- 7) To determine the molecular weight of high polymer by viscosity measurement.
- 8) To find out partition coefficient of Iodine/Benzoic/Salicylic acid between benzene and water.

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Distribution of marks:

The Practical examination will be based on the syllabus for Industrial Chemistry (Elective Paper).

Time: 6-8 hours (one day examination)

Marks: 100

I) Exercise -1 (Based on Synthesis)	- 40 Marks
II) Exercise-2 (Based on Quantative Analysis)	- 40 Marks
III) Record	- 10Marks
IV) Viva- Voce	- 10 Marks
Total	-100 Marks

List Of Books-

1. Practical Engineering by S. S. Dara.
2. Labortory Preparation of Microchemistry by E. M. M. Effery, McGraw Hill.
3. Practical Course in Polymer Chemistry by S. J. Pnnea, Pargaman Press
4. Practical Pharmacognosy by T. B. Willis.
5. Practical Pharmacognosy by T. N. Vasudevan.
6. Indian Pharmacopea-1985, British Pharmacopea-1990.
7. Handbook of Drugs and Cosmetics by Mehrotra
8. Methods of Pesticide Analysis by Sree Ramuly U. I. Oxford and IBH Publishing Co.
9. Methods of testing for petroleum and petroleum products. IS 1448-1960 Part I to Part IV. Published by ISI New Delhi 1967
10. IP Stands for Petroleum and products Published Applied Service Publisher Ltd. London, 33rd Edition 1974.
11. American Stds. For testing Materials, New York 1967.
12. Textbook of Inorganic Chemistry by A. I. Vogel.
13. Instrumental Methods of Analysis by Willard, Merit and Dean
14. Industrials Chemicals, Faith et. al. Wiley Interscience New York
15. Textbook Of Practical Organic Chemistry by I. C. Voley.
16. Industrial Organic Chemistry by J. K. Stille
17. Unit Operations by Kale
18. Reagents for Organic Synthesis Fisher and Fisher.
19. Technique of Organic Chemistry Vol I, Part I- IV A. Weishberger.

**SEMESER IV
Practical – VII
Project Work**

lab 8

Total Hours: 90 hrs. (9 Hours per week)

Marks: 100

The students will develop utilities such as analytical spectra, simulation programs that will supplement laboratory exercises in their subject of specialisation. Literature survey, Studies of reactions, synthesis, mechanism, isolation of natural products, standardization of reaction conditions, new methods etc. External and internal examiners will examine this jointly at the time of practical examination. (Students should present his/her work in power point presentation. Open Viva is compulsory. Soft Copy of presentation in CD should be submitted with dissertation.)

Study Tour:

Educational/Industrial tour is compulsory for M.Sc. Chemistry.

- (i) Semester I/II: Visit to local Industry/Institute.
- (ii) Semester III/IV: Education tour to visit the industry/Research laboratory (Long Tour).
Students should submit their tour report at the end of Semester II and Semester IV respectively with proof of visiting (Photo etc.).

• List of equipments/apparatus required for the M.Sc. Chemistry Semester-I to IV Practicals.

1. Rotaevaporater	01 no./batch
2. Crycooler	01 no./batch
3. Sonicator bath	01 no./batch
4. Stirrer With Hot Plate	04 nos./batch
5. Eye Washer	01 no./batch
6. Chemdraw Software (version12)	01 no./batch
2. Conductivity meter	03 nos./batch
2. pH meter	03 nos./batch
3. Potentiometer	03 nos./batch
4. Polarimeter	02 nos./batch
5. Centrifuge machine	02 nos./batch
6. Vaccum Pump	01 no./batch
7. Hot air oven	01 no./batch
8. Blower hot & cold	03 nos./batch
9. Stop watch	10 nos./batch
10. Weight box con.100 gm.	10 nos./batch
11. Analytical double pan balance	10 nos./batch
12. One pan electronic balance	02 nos./batch
13. Tripple beam balance	02 nos./batch
14. Melting point apparatus	02 nos./batch
15. Spectrophotometer	02 nos./batch
16. Water still	01 no./lab