University of Pune

S. Y. B. Sc. [Botany]

Class – S.Y. B .Sc. (To be implemented From June 2014)		
Paper	**Semester - I**	**Semester – II**
I	Taxonomy of Angiosperms and Plant community	Plant Anatomy and Embryology
II	Plant Physiology	Plant Biotechnology
III	Practicals based on Theory courses (Paper I and II)	

Equivalence of previous syllabus at S.Y.B.Sc. Botany

Paper	**2008 Pattern (Implemented from 2009)**	**2013 Pattern (To be implemented from 2014)**
Paper I Semester I	BO-211: Fundamentals of Plant Systematics and Plant Ecology	BO-211: Taxonomy of Angiosperms and Plant community
Paper II Semester I	BO-212:Fundamentals of Plant Physiology	BO-212:Plant Physiology
Paper I Semester I	BO-221: Structural Botany(Anatomy, Embryology and Palynology)	BO-221: Plant Anatomy and Embryology
Paper II Semester I	BO-222: Fundamentals of Plant Biotechnology	BO-222: Plant Biotechnology
Practical Course	Practical based on theory courses (Paper I and Paper II)	Practical based on theory courses (Paper I and Paper II)

S.Y.B.Sc. Botany

(Semester I, Paper I)

Taxonomy of Angiosperms and Plant Community (48 Lectures)

1. Introduction to Plant Taxonomy **3L**

1.1 Definition, scope, objectives and importance

1.2 Identification, classification, nomenclature

1.3 Concept of Systematics

2. Systems of classification **6L**

2.1 Types of systems with their merits and limitations- a)Artificial system- Carl Linnaeus , b)Natural system -Bentham and Hooker, c) Phylogenetic system- Engler and Prantl

3. Taxonomic literature **2L**

Flora, monograph, revisions, manuals, journals, periodicals and references books.

4. Sources of data for Systematics **6L**

4.1 Morphology

4.2 Anatomy

4.3 Cytology

4.4 Embryology

4.5 Phytochemistry

4.6 Molecular biology

5. Botanical Nomenclature **6L**

5.1 History

5.2 Binomial nomenclature

5.3 ICBN- principles

5.4 Rules of nomenclature

5.5 Coining of generic names and specific epithets.

5.6 Ranks and endings of taxa names

5.7 Principle of priority

5.8 Effective and valid publications

5.9 Single and double authority citation

5.10 *Nomina conservanda*

6. Study of Plant Families **11L**

Study of following families with reference to systematic position, salient features, floral formula, floral diagram and any five examples with their economic importance – Annonaceae, Meliaceae, Myrtaceae, Rubiaceae, Solanaceae, Asclepiadaceae, Euphorbiaceae and Amaryllidaceae

7. Computer in taxonomy **4L**

7.1 Concept of herbarium their advantages and limitations

7.2 Digital /e-herbarium and their advantages

7.3 Data bases: concept and needs.

7.4 Use of computer in plant classification

8. Introduction to ecology **5L**

8.1 Definition

8.2 Concept

8.3 Autecology and synecology

8.4 Ecosystem and its components: biotic and abiotic.

8.5 Food chain

8.6 Food web

8.7 Ecological pyramids

9. Ecological grouping of the plants **5L**

Ecological grouping of the plants with reference to their significance of adaptive external and internal features: a) Hydrophytes, b) Mesophytes c)Xerophytes d) Halophytes with examples.

References-

1. Chopra G.L.- Angiosperms
2. Cronquist, A. 1968. The Evolution and Classification of Flowering Plants. Thomas Nel and Sons Ltd. London.
3. Datta S.C.- A Hand Book of Systematic Botany
4. Davis P.H and V.H Heywood 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd London.
5. Gurucharan Singh 2005- Systematics theory and practice (Oxford IBH)
6. Heywood V.H 1967. Plant Taxonomy, London.
7. Lawrence, G.H.M 1951. Taxonomy of Vascular Plants. N.Y.

8. Lawrence G.H.M 1955. An Introduction to Plant Taxonomy N.Y.
9. Naik V.N.- Taxonomy of Angiosperms.
10. Pande B.P 1997. Taxonomy of Angiosperms. S.Chand.
11. Priti Shukla and Shital Mishra- An introduction to Taxonomy of angiosperms
12. Rendle A.B. 1925. The Classification of flowering plants. 2 Vols. London.
13. Santapau H. 1953. The Flora of Khandala on the Western Ghats of India.
14. Singh V. and D.K Jain, 1981 Taxonomy of Angiosperms. Rastogi Publication, Meerut.
15. Sharma O.P, Plant taxonomy (Tata Mc grow Hill)
16. Stewart W.N. and Rathwell G.W. 1993. Paleobotany and the Evolution of plants. Cambridge University Press.
17. Swingle D.B. 1946. A Text book of Systematic Botany. Mc Graw Hill Book Co. New York.
18. Takhtajan A. 1969. Flowering Plants; Origin and Disposal.
19. Theodore Cooke(1903)- The flora of The Presidency of Bombay Vol. I, II, III
20. V.V.Shivrajan-Introduction to Principles plant taxonomy
21. Yadav S.R. and Sardesai M.R.- Flora of Kolhapur District.

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(Semester I, Paper II)

Plant Physiology (48 Lectures)

1. Introduction to Plant Physiology **2L**

Brief history,Scope and applications of plant physiology

2. Plant – water relations **8L**

2.1 Physico-chemical properties of water

2.2 Membrane structure, permeability and aquaporin

2.3 Diffusion – Definition, factors affecting diffusion, importance of diffusion in plants

2.4 Osmosis – Definition, types of solutions – hypotonic, hypertonic and isotonic, endosmosis and exosmosis, concept of osmotic pressure (OP), turgor pressure (TP), wall pressure (WP), Diffusion pressure deficit (DPD), relation between OP, TP and DPD, role of osmosis in plants.

2.5 Plasmolysis – Definition, mechanism, deplasmolysis, significance of plasmolysis

2.6 Imbibition – Concept, mechanism and significance

3. Absorption of water **3L**

3.1 Role of water in plants

3.2 Concept of water potential and capillary water

3.3 Mechanisms of water absorption

3.4 Factors affecting rate of water absorption

4. Ascent of sap **4L**

4.1 Introduction and definition.

4.2 Theories of ascent of sap

4.3 Vital theories: Jamin – Chame theory and Bose theory

4.3.1 Physical force theories: a) Capillary theory, b) Imbibitional theory, c) Atmospheric pressure theory,

4.3.2 Transpiration pull or cohesion-tension theory, evidences and objections

4.4 Factors affecting ascent of sap

5. Transpiration **6L**

5.1 Definition

5.2 Types of transpiration – cuticular, lenticular and stomatal

5.3 Structure of stomata

5.4 Mechanism of opening and closing of stomata –Steward's hypothesis, active K^+ transport mechanism

5.5 Factors affecting the rate of transpiration

5.6 Significance of transpiration

5.7 Antitranspirants

5.8 Guttation

5.9 Exudation

6. Plant growth and plant growth regulators 6L

6.1 Introduction

6.2 Phases of growth

6.3 Measurement of growth- Arc auxanometer, Bose crescograph, fresh and dry weight method

6.4 Factors affecting growth

6.5 Plant Growth Regulators- Introduction and definition

6.6 Properties and practical applications of auxins, cytokinins, gibberellins, ethylene and abscisic acid

7. Nitrogen metabolism 8L

7.1 Introduction

7.2 Biological nitrogen fixation

7.2.1 Symbiotic nitrogen fixation, nitrogenase enzyme- structure and function

7.2.2 Non-symbiotic nitrogen fixation

7.3 Denitrification, ammonification and nitrification

7.4 Reductive amination and transamination

7.5 Role of nitrogen in plants

8. Seed dormancy and germination 4L

8.1 Definition and types of seed dormancy

8.2 Methods to break seed dormancy

8.3 Metabolic changes during seed germination

9. Physiology of flowering 7L

9.1 Photoperiodism – Concept, definition, short day plants, long day plants and day neutral plants, photoperiodic induction, phytochrome and flowering

9.2 Phytohormones and initiation of flowering

9.3 Applications of photoperiodism

9.4 Vernalisation – concept and definition, mechanism of vernalisation, applications of vernalisation, devernalization

References:

1. Bidwell, R.G.S. 1974. Plant Physiology. Macmillan Pub. Co., N.Y.
2. Devlin, R.M. And F.H. Witham. 1983. Plant Physiology. Willard Grant Press. U.S.A.
3. Hans-Walter Heldt. 1997. Plant Biochemistry And Molecular Biology. Oxford University Press, New York. Usa.
4. Moore, T.C. 1979. Biochemistry And Physiology Of Plant Hormones. Springer-Verlag. Berlin.
5. Raman, K. 1997. Transport Phenomena In Plants. Narosa Publishing House. New Delhi.
6. Jain, V.K. (2000): Fundamentals Of Plant Physiology,S.Chand&Co, New Delhi.
7. Pandey, S.N. (1991): Plant Physiology, Vikas Publishing House (P) Ltd., New Delhi, India.
8. Verma, V. (2007): Text Book Of Plant Physiology, Ane Books India, New Delhi.
9. Nobel, P.S. 2009. Physicochemical and Environmental Plant Physiology.4th edition Academic Press, UK
10. Taiz, L. and Zeiger, E. 2006. Plant Physiology. 4th Edition. Sinnauers Associates, Saunders land, Massachusetts, USA
11. Salisbury F.B. and Ross C.B. 2005. Plant Physiology. 5th Edition. Wadsworth Publishing Co. Belmont CA.
12. Helgi OPik, Stephen A. Rolfe, Arthur J. Willis. 2005. The Physiology of Flowering Plants, Cambridge University Press, UK
13. Kirkham, M.B. 2004. Principles of Soil and Plant Water Relations. Elsevier, Amsterdam, Netherlands.
14. Dennis, D.T., Turpin, D.H., Lefebvre, D.D. and Layzell, D.B. 1997. Plant Metabolism. 2nd Edition. Longman Group, U.K.
15. Fitter, A. and Hay, R.K.M. 2001. Environmental Physiology of Plants. Academic Press, UK.
16. Press, M.C., Barker, M.G., and Scholes, J.D. 2000. Physiological Plant Ecology, British Ecological Society Symposium, Volume 39, Blackwell Science, UK.

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(Semester II, Paper I)

Plant Anatomy and Embryology (48 Lectures)

Plant anatomy:

1. Introduction **2L**

Definition, scope of plant anatomy and types of tissues

2. Epidermal tissue system **4L**

Structure and function of epidermal tissue system, uniseriate and multiseriate epidermis, stomata: structure, types and functions, epidermal outgrowth: glandular and non-glandular

3. Mechanical tissue system **4L**

Principles involved in distribution of mechanical tissues – inflexibility, incompressibility, inextensibility and shearing stress, tissues providing mechanical support, their distribution in leaf, stem and root of dicots and monocots.

4. Vascular tissue system **4L**

Structure and function of xylem, phloem and cambium

5. Normal secondary growth **5L**

Introduction, cambium and its role, process in stems of *Helianthus annus* and *Annona sqamosa*, extrastelar and intrastelar secondary growth**,** annual rings, periderm, bark, tylosis and lenticel

6. Anomalous secondary growth **5L**

Introduction, causes, anomalous secondary growth in dicot stem (*Bignonia*) dicot root (*Raphanus*) and monocot stem (*Dracaena*).

Plant Embryology

7. Introduction **1L**

Definition and scope of plant embryology

8. Microsporangium and male gametophyte **5L**

a. Microsporangium**:** structure of tetrasporangiate anther, types of tapetum, sporogenous tissue.
b. Microsporogenesis: process and its types, types of microspore tetrad.
c. Male gametophyte: structure and development of male gametophyte.

10. Megasporangium and female gametophyte: 7L

a. Megasporangium: structure, types of ovules – anatropous, orthotropous, amphitropous, campylotropous, circinotropous.
b. Megasporogenesis: tenuinucellate and crassinucellate ovules, types of megaspore tetrads.
c. Female gametophyte: structure of typical embryo sac, types of embryo sacs with examples – monosporic, bisporic and tetrasporic.

11. Fertilization: 5L

Mechanism of pollination- entomophily, anemophily, hydrophily, zoophily, germination of pollen grain, double fertilization (syngamy and triple fusion) and its significance.

12. Endosperm and embryo 6L

a. Endosperm: Types – nuclear, helobial and cellular.
b. Embryogeny**:** structure of dicot and monocot embryo and seed formation.

References

1. Plant Anatomy, Chandurkar P J, Plant Anatomy Oxford and IBH publication Co. New Delhi 1971
2. B P Pandey, Plant Anatomy,S Chand and Co. Ltd, New Delhi 1978
3. Greulach V A and Adams J E Plant- An introduction to Modern Biology, Toppen Co. Ltd, Tokyo,
4. Eams and Mc Daniel,An Introduction to Plant Anatomy, McGraw –Hill Book Co. Ltd and Kogakusha Co, Tokyo, Japan
5. Adriance S Foster Practical Plant Anatomy, D Van Nostrand Co. INC, Newyork
6. Esau, Plant Anatomy, Wiley Toppan Co. California, USA
7. Pijush Roy, Plant Anatomy,New Central Book Agency Ltd, Kolkata
8. Pandey S N and Ajanta Chadha, Plant Anatomy and Embryology,Vikas Publishing House,Pvt, Ltd, New Delhi
9. Bhojwani S S and Bhatnagar S P, An Embryology of Angiosperms
10. Maheshwari P, An introduction to Embryology of Angiosperm
11. Nair P K K Essentials of Palynology.

S. Y. B. Sc. [Botany]

(Semester II, Paper II)

Plant Biotechnology (48 Lectures)

1. **Introduction** **2L**

1.1 Biotechnology- Definition, concept and scope

1.2 Interdisciplinary nature of biotechnology

2 . **Enzyme Technology** **7L**

2.1 Introduction, definition and properties of enzymes.

2.2 Classification of enzymes

2.3 Industrial applications of enzymes.

2.4 Production of amylase, proteases and lipase enzyme

2.5 Enzymes immobilization - concept and techniques of immobilization

3. **Fermentation Technology**. **7L**

3.1 Introduction.

3.2 Liquid and solid state fermentations

3.3 Principles of microbial growth

3.4 Bioreactors used in fermentations- stirred tank and tubular tower and digestive tank fermenters

3.5 Media composition for liquid and solid state fermentations

3.6 Industrial applications of fermentation

3.7 Downstream processing- citric acid production.

4. **Single cell protein** **5L**

4.1 Introduction

4.2 Need of proteins in diet

4.4 Production of SCP from algae (*Spirulina*) and fungi (Yeast)

4.5 The economic implications of SCP

4.6 Acceptability of SCP

5. **Environmental Biotechnology** **6L**

5.1 Introduction

5.2 Phytoremediation- definition and concept

5.3 Methods of phytoremediation- Rhizofilteration, phytoextraction, phytostabilization, phytovolatization, phytodegradation,

5.4 Environmental sustainability

6 . **Basics of plant genetic engineering** **7L**

6.1 Introduction and structure of DNA

6.2 Structure of gene in prokaryots and eukaryots- Promoter, coding region and terminator

6.3 General method of gene isolation from the plants-DNA isolation, restriction enzymes, restriction digestion of DNA, DNA electrophoresis, southern hybridization, lygation of DNA fragments

6.4 Gene cloning- vectors used for gene cloning

7**. Methods of gene transfer in plants** **8**L

7.1 Direct gene transfer methods- Electroporation, biolystic gene transfer, liposome mediated transfer.

7.2 Vector mediated gene transfer- *Agrobacterium* mediated gene transfer in plants, Ti-plasmid: structure and functions, Ti plasmid based vectors, advantages.

8**. Application of plant genetic engineering in crop improvement.** **4L**

8.1 Introduction

8.2 Insect pest resistance, abiotic stress tolerance, herbicide resistance, storage protein quality

9. **Nano-biotechnology** **2L**

9.1 Definition and concept

9.2 Applications of nanotechnology in agriculture (fertilizers and pesticides).

REFERENCES:

1. Nanobiotechnology, Concepts, Applications and perspectives, C.M. Niemeyer and C.A. Mirkin ; 2004; WILEY-VCH,.
2. Bionanotechnology: concepts, Lessons from Nature", David.S. Goodsell, 2004 Wiley-Liss
3. Nanobiotechnology Protocols; Sandra J Rosenthal, David W Wright 2005, Humana Press Inc
4. Nanoscale Technology in Biological Systems; R.S. Greco, F.B.Prinz and R.L.Smith 2005 CRC press,.
5. Fundamental Molecular Biology ; Allison LA; 2007
6. Recombinant DNA, Watson et al ; 5th Ed; 2006
7. Techniques for Engineering Genes ; Curell BR et al;2004
8. Techniques for Molecular Biology ; Tagu D & Moussard C; INRA; 2006
9. Gene Cloning and DNA Analysis ; 5th Ed ; Brown TA ; 2006
10. Analysis of Genes and Genomes ; Reece RJ ; Wiley; 2004
11. Recombinant DNA and Biotechnology ; 2nd Ed ; Kreuzer H and Massey A ;ASM;2006
12. Text book of biotechnology, R.C.Dubey, 2009, S.Chand, Delhi

S. Y. B. Sc. [Botany] Paper III

Practicals Based on Theory Paper I and II

a) Taxonomy of Angiosperms and Plant Community

1. Description of flowering plant in botanical terms (01 P)
2. Study of plant families (any four) (03 P)
3. Study of ecological adaptations in Hydrophytes with any two examples (01P)
4. Study of ecological adaptations in Xerophytes with any two examples (01P)
5. Study of vegetation by list count quadrat method. (01P)
6. Study of tools of taxonomy and ecological instruments (any four each) (01P)

b) Plant Physiology

1. Determine water holding capacity (WHC) and pH of soil (pH by pH meter.) (01 P)
2. Study of plasmolysis in suitable plant material (01 P)
3. Determination of Diffusion Pressure Deficit (DPD). (01 P)
4. Determine rate of transpiration under different conditions of (01 P)
   Sunlight, Shade and wind
5. Demonstration Experiments. (Compulsory Practical) (01 P)
   a. Curling Experiment
   b. Imbibition in seeds
   c. Arc Auxanometer
   d. Effect of auxins on rooting
   e. Transpiration pull
   f. Spectrophotometer
   g. Portable leaf area meter
   h. Conductivity meter
   i. Centrifuge
6. Assessing seed viability by TTC method (01 P)

c) Plant Anatomy and Embryology

1. Study of epidermal tissue system – non-glandular and glandular trichomes, multilayered epidermis, typical stomata (dicot and monocot). (01 P)
2. Study of mechanical tissues and their distribution in root, stem and leaves. (01 P)
3. Study of normal secondary growth in dicot stem – *Annona* /*Moringa*. (01 P)
   (Double stained temporary preparation).

4. Study of anomalous secondary growth in *Bignonia* and *Dracaena* stem. (01 P)
   (Double stained temporary preparation).
5. Study of tetrasporangiate anther and types of ovules. (01 P)
6. Study of dicot and monocot embryo. (01 P)

b) Plant Biotechnology

1. Production of citric acid by *Aspergillus niger* and estimation of citric acid by titration method. (02 P)
2. Production of single cell protein production i.e. *Spirulina* / yeast and study of commercial products (01 P)
3. Demonstration of fermentation and fermentation products (01 P)
4. Demonstration of separation of plasmid DNA by agarose gel electrophoresis (01 P)
5. Demonstration of enzyme immobilization (01 P)

N.B. Botanical excursion tour and submission of at least five correctly identified wild plant photographs is compulsory.

UNIVERSITY OF PUNE

REVISED SYLLABUS FOR S.Y. B.Sc. CHEMISTRY FROM 2014-2015

(According to Semester system 2014-2015)

Course structure: There will be four theory papers of 50 Marks each, (40 marks external + 10 marks internal) and one practical course of 100 marks. (80 marks External + 20 marks Internal). The examination will be held semester-wise for theory papers whereas the examination for practical course CH-223 will be held at the end of **SEMETER-II**

SEMESTER	PAPER	COURSE TITLE	MARKS
I	CH-211	PHYSICAL & ANALYTICAL CHEMISTRY	50
I	CH-212	ORGANIC & INORGANIC CHEMISTRY	50
II	CH-221	PHYSICAL & ANALYTICAL CHEMISTRY	50
II	CH-222	ORGANIC & INORGANIC CHEMISTRY	50

Practical Course in Chemistry: CH-223 - 100 Marks

Equivalence of Previous Syllabus:

Semester	Old Course (2009-10)	New Course (2014-15)
I	CH-211 : Physical Chemistry	CH-211 : Physical & Analytical Chemistry
I	CH-212 : Organic Chemistry	CH-212 : Organic & Inorganic Chemistry
II	CH-221 : Inorganic Chemistry	CH-222 : Organic & Inorganic Chemistry
II	CH-222 : Analytical Chemistry	CH-221 : Physical & Analytical Chemistry
	CH- 223: Practical	CH- 223: Practical

S. Y. B. Sc. (Chemistry) Syllabus

Semester - I

Paper 1: CH-211: Physical and Analytical Chemistry

Paper 2: CH-212: Organic and Inorganic Chemistry

Semester - II

Paper 3: CH-221: Physical and Analytical Chemistry

Paper 4: CH-222: Organic and Inorganic Chemistry

Practical Course in Chemistry CH-223 (To be conducted during both semesters)

SEMESTER – I

Paper 1: CH-211

Section – I

Physical Chemistry

Chapter 1: Elementary Chemical Kinetics **[10]**

Introduction to Chemical kinetics, molecularity and order of reaction , reaction rates, rate laws, rate constant and its significance, Integrated rate law expression and its characteristics–first order, second order (single reactant, two reactants involved), examples of 1^{st} and 2^{nd} order reaction, pseudomolecular reactions, factors affecting rate of reaction, measurement of rate of reaction, numericals.

Aim: To introduce concept of kinetics at undergraduate level.

Objectives: Student should learn

i. Concept of kinetics , terms used , rate laws , types of order
ii. Discuss examples of first order and second order reaction
iii. Pseudo molecular reactions
iv. Factors affecting on rate of reaction
v. Techniques of measurement of rate of reaction
vi. To solve problems

Chapter 2: Photochemistry **[10]**

Introduction, thermal reactions and photochemical reactions, laws of photochemistry, quantum yield, measurement of quantum yield, types of photochemical reactions-photosynthesis, photolysis, photocatalysis, photosensitization, photophysical process–fluorescence, phosphorescence, quenching, chemiluminiscence, numericals.

Aim: To impart basic knowledge of photochemistry and its applications

Objectives: After studying the chapter student should be able to

i. Know about photochemistry
ii. Understand difference between thermal and photochemical reactions
iii. Understand laws of photochemistry
iv. Learn what is quantum yield and it's measurement
v. Know Types of photochemical reactions and photophysical process
vi. Know about quenching and chemiluminence
vii. To solve numericals

Chapter 3: Distribution law **[04]**

Nernst distribution law, Statement and thermodynamic proof for Nernst distribution law, association and dissociation of solute in solvent, application of distribution law, Numericals.

Aim: To understand Nernst Distribution Law and its applications

Objectives: Students should learn

i. Concept of distribution of solute amongst pair of immiscible solvents
ii. Distribution law and it's thermodynamic proof
iii. Distribution law and nature of solute in solution state
iv. Application – Solvent extraction
v. To solve numericals

Ref.1: Page no. 298 to 302 and 775-800

Section – II

Analytical Chemistry

Chapter 4: Introduction to Analytical Chemistry **[3]**

Introduction, Chemical analysis, applications of chemical analysis, sampling, types of analysis, Common techniques, Instrumental methods, other techniques, factors affecting on choice of method

Aim: To introduce basics of analytical chemistry

Objectives: Students should learn

i. What is Analytical Chemistry
ii. Chemical analysis and its applications
iii. Sampling
iv. Common techniques
v. Instrumental methods and other techniques
vi. Choice of method

Ref: Vogel chapter 1 (Page 1 - 11) up to section 1.9 except use of literature.

Chapter 5: Errors in Quantitative Analysis **[5]**

Introduction, Error, Accuracy, precision, methods of expressing accuracy and precision, classification of errors, significant figures and computations, distribution of random errors, mean and standard deviations, reliability of results, Numericals.

Aim: To understand errors and its interpretation

Objectives: Students should learn

i. Meaning of error and terms related to expression & estimation of errors
ii. Methods of expressing accuracy and precision
iii. Classification of errors
iv. Significant figures and computations
v. Distribution of errors
vi. Mean and standard deviations
vii. Reliability of results

Ref: Vogel, 5thedn chapter 4 (127-137 up to section 4.10) extended up to 4.13

Chapter 6: Inorganic Qualitative Analysis [8]

Basic principle, common ion effect, solubility, solubility product, preparation of original solution, classification of basic radicals in groups, separation of basic radicals, removal of interfering anions (phosphate and borate), detection of acid radicals.

Aim: To study the theory underlying Inorganic Qualitative analysis

Objectives: A student should know

i. Basic principles in qualitative analysis
ii. Meaning of common ion effect
iii. Role of common ion effect and solubility product
iv. Different groups for basic radicals
v. Group reagent and precipitating agents
vi. Interfering anions and its removal
vii. Separation for basic radicals
vii. Method of detection of acidic radicals

Chapter 7: Analysis of Organic Compounds (Qualitative & Quantitative) [8]

I. Qualitative

A. Types of organic compounds, Characteristic tests and classifications, reactions of different functional groups, analysis of binary mixtures.

II Quantitative

B. Analysis–estimation of C, H, (O) by combustion tube, detection of nitrogen, sulfur, halogen and phosphorous by Lassigen's test.
C. Estimation of nitrogen by Dumas's Kjeldahl's method, estimation of halogen, sulphur and phosphate by Carious method.
D. Determination of empirical and molecular formula, numerical problems.

Aim: To disseminate knowledge of qualitative & quantitative analysis of organic compounds

Objectives: A student should know-

i. Classification of compounds with different functional groups
ii. Different tests for detection of elements like C, H, (O), N, S & P.
iii. Characteristic tests for different functional groups
iv. Different colour tests and the reactions
v. Quantitative analysis of C, H by Liebig's method
vi. Kjeldahl's method with example
vii. Carius tube method with example
vii. Empirical and molecular formula
vii. To solve numericals.

Name of the reference book:

1. Analytical Chemistry by G.D. Christian, sixth edition. Pages: 1-10
2. Vogel's textbook of Quantitative Analysis, sixth edition
   J. Mendham, R.C. Denney, J.D. Barnes, MJK Thomas
3. A textbook of macro & semi micro qualitative analysis by
   A.J. Vogel, fifth edition
4. Quantitative Organic Analysis, fourth edition, A.J. Vogel, ELBS

Paper 2: CH-212

Section – I

Organic Chemistry

Chapter 1: Stereoisomerism **[12]**

Introduction to optical isomerism: Chirality, optical activity and polarimetry, enantiomers, absolute configuration, R/S system nomenclature with wedge and Fischer representation of two chiral centres, erythro, threo, meso-diastereomers with R/S configuration. Stereoisomerism Baeye'rs strain theory, heat of combustion, cycloalkanes, factors affecting the stability of conformation, Conformation of cyclohexane - equatorial and axial bonds, Monosubstituted cyclohexane stability with $-CH_3$ and $-C(CH_3)_3$ substitutes. Structures of geometrical isomers of dimetylcyclohexane only.

Ref. 3

Aims and Objectives

Students should be able to –

i) Identify chiral center in the given organic compounds.

ii) Define Erythro, threo, meso, diasteroisomers with suitable examples.

iii) Able to find R/S configuration in compounds containing two chiral centers.

iv) Explain Bayer's strain theory, Heat of combustion and relates stability of cycloalkanes.

v) Explain the stability of cyclohexanes.

vi) Draw the structure of boat and chair configuration of cyclohexane.

vii) Draw axial and equatorial bonds in cyclohexane.

viii) Draw structure of conformations of mono- & disubstituted cyclohexanes

ix) Explain the stability of axial and equatorial conformation of monosubstituted cyclohexanes.

Chapter 2: Organic reaction Mechanism **[12]**

Introduction, types of reagents–electrophile, nucleophile and free radical.

Types of organic reactions: Addition, Elimination (β-elimination and Hofmann elimination), substitution (aliphatic electrophilic and nucleophilic, aromatic electrophilic) and rearrangement.

Mechanism: (i) Aldol condensation (ii) Markovnikov and anti-Markovnikov addition reaction (iii) Saytzeff and Hoffmann elimination (iv) S_N^1 and S_N^2 reactions (v) Hofmann rearrangement.

Ref. 1 & 4

Aims and Objectives

Students should be able to –

i) Define and classify heterocyclic compounds.

ii) Use Huckel rule to predict aromaticity.

iii) Suggest synthetic route for preparation of various heterocyclic compounds.

iv) Write and complete various reactions of heterocyclic compounds.

v) Predict products.

Reference Books:

Ref. 1: Organic Chemistry-6h Ed. Morrison and Boyd Prentice Hall of India Prt Ltd,New Delhi-2001.

Ref. 2: Outline of Biochemistry 5h Ed., Conn, Stumpf Bruening and Roy Doi John Wiley 1987.

Ref. 3: Stereochemistry of carbon compounds - E. L. Eliel

Ref. 4: Reactions, rearrangements and reagents – S N Sanyal

Section – II

Inorganic Chemistry

Chapter 3: General Principles of Metallurgy: [6]

Introduction, occurrence of metals, ores and minerals, types of ores, operations involved in metallurgy, crushing, connotation, various methods of concentration such as hand picking, gravity separation, magnetic separation. Froth flotation, Calcinations, Roasting etc. Reduction, various methods of reduction such as smelting, Aluminothermic process and electrolytic reduction, Refining of metals, various methods of refining such as poling, liquation, electrolytic and vapour phase refining (Van Arkel Process).

Aims: To study principles and process of metallurgy.

Objectives: A student should be able -

i) To differentiate between ore and minerals.

ii) To differentiate between calcination and roasting and smelting.

iii) To know the different methods for separation of gangue or matrix from metallic compounds.

iv) To know the terms smelting, flux.

References:

i) Advanced Inorganic Chemistry, Satyaprakash, Tuli, Basu, pages 262-271.

ii) Text book of Inorganic Chemistry, P.L. Soni, pages 2.3-2.8, 2.13-2.17.

Chapter 4: Metallurgy of Aluminium (Electrometallurgy): [4]

Occurrence, Physiochemical principles, Extraction of Aluminium, Purification of bauxite by Baeyer's process, Electrolysis of alumina, application of aluminum and its alloys.

Aims: To study metallurgy of Aluminium.

Objectives: A student should be able -

i) To know physico-chemical principles involved in electrometallurgy.

ii) To understand electrolysis of alumina and its refining.

iii) To explain the uses of Aluminum and its alloys.

iv) To know purification of bauxite ore.

References:

i) Advanced Inorganic Chemistry, Satyaprakash, Tuli, Basu pages 458-463.

ii) Text book of Inorganic Chemistry, P.L. Soni pages 2.209 to 2.211

Chapter 5: Metallurgy of Iron and Steel (Pyrometallurgy) [8]

Occurrence, concentration, calcination, smelting physio-chemical principles, reactions in the blast furnace, wrought iron, manufacture of steel by Bessemer and L.D. process, its composition and applications.

Aims: To study metallurgy of Iron.

Objectives: A student should be able -

i) To explain the term pyrometallurgy and to explain the physico chemical principles involved in the reduction process by carbon monoxide.

ii) To know different reactions in the blast furnace.

iii) To differentiate between properties of pig iron and wrought iron.

iv) To explain the basic principles of different methods for preparation of steel.

v) To explain the merits and demerits of different methods.

Reference:

i) Advanced Inorganic Chemistry, Satyaprakash, Tuli, Basu pages 830-849.

Chapter 6: Corrosion and Passivity: [6]

(a) Corrosion : Definition of corrosion, Types of corrosion, Atmospheric, Immersed, Mechanism of electrochemical corrosion, Factors affecting corrosion - position of metal in E. C. S., purity effect of moisture, effect of oxygen, pH, physical state of metal, methods of protection of metal from corrosion- alloy formation, making metal cathodic, controlling

external condition. Coating-galvanising, Tinning, electroplating, metal cladding, organic coating.

(b) Passivity : Definition, Theories of passivity - (i) Oxide film theory (ii) Gaseous film theory (iii) Physical film theory, Valence theory, Catalytic theory, Allotropic theory, Electrochemical passivity.

A student should know -

i) Definition of corrosion.

ii) Types of corrosion.

iii) Mechanism of corrosion.

iv) Factors affecting corrosion.

v) Methods of prevention of metal from corrosion.

vi) Meaning of passivity.

vii) Different theories of passivity.

viii) Galvanising, Tinning, Electroplating from corrosion.

Reference:

i) Introduction to Electrochemistry by S. Glasstone, 2nd Ed. pages 491-503.

SEMESTER – II

Paper 3: CH-221

Section – I

Physical Chemistry

Chapter 1: Free Energy and Equilibrium **[12]**

Introduction, Helmholtz free energy, variation of Helmholtz free energy with volume and temperature, Helmholtz free change energy for chemical reaction,Gibb's free energy, Variation of Gibb's free energy with pressure and temperature, Gibb's free energy change for chemical reaction, Free energy change for physical transitions, Free energy change for an ideal gas; standard free energy change, Gibb's-Helmholtz equation, Properties and significance of Gibb's free change, Van't Hoff reaction isotherm, thermodynamic equilibrium constants, Relation between Kp and Kc for gaseous reactions, variation of equilibrium constant with temperature, Criteria for chemical equilibrium, Physical equilibrium, Clapeyron equation, Clausius–Clapeyron equation, Application of Clausius–Clapeyron equation, numericals.

Aim: To conceptualize phenomenon of free energy and equilibria.

Objectives: The student should able to know

i. Free energy concepts, types and its variation
ii. Free energy change for chemical reaction and physical transition
iii. Free energy change for ideal gases
iv. Gibb's Helmholtz equations and its properties & significance
v. van't Hoff reaction isotherm and thermodynamic equilibrium constants,
vi. Chemical and physical equilibrium
vii. Clausius –Clapeyron equation and its applications
vii. To solve numericals.

Ref. 1: Page no. 189 to 200, 206

Ref. 2: Relevant pages.

Chapter 2: Solutions of Liquids in Liquids **[12]**

Types of solutions, Ideal solutions, Raoult's law, ideal and non ideal solutions, Henry's law, Application of Henry's law with example CS_2 in acetone, problems based on Raoult's law and Henry's law, vapor pressure–composition diagram of ideal and non ideal solution, temperature composition diagram of miscible binary solutions, distillation from temperature–composition diagram, Azeotropes, Partially immiscible liquids.

Aim: To distinguish behavior of liquid phase solutions.

Objectives: The student should to know

i. Ideal and non ideal solutions and laws governing these solutions
ii. Interpretation of vapor pressure–composition diagram
iii. Interpretation of temperature composition diagram.
iv. Distillation from temperature – composition diagram,
v. Azeotropes
vi. Partially immiscible liquids.
vii. To solve numericals

Ref.2: Pages 229 to 247, 254 to 258

Reference books:

1. Principles of Physical Chemistry by S.H. Maron & C. Prutton 4th edition.
2. Physical Chemistry by W.J. Moore 5th edition.
3. Physical Chemistry by P.W. Atkin 4th edition
4. Physical Chemistry by D. Alberty 3rd edition.

Section – II

Analytical Chemistry

Chapter 3: Introduction to volumetric analysis [6]

Introduction, methods of expressing concentrations, primary and secondary standard solutions. Apparatus used and their calibration: burettes, microburettes, volumetric pipettes, graduated pipettes, volumetric flask, methods of calibration, Instrumental & non-instrumental analysis – principles & types.

Aim: To provide basic knowledge essential for volumetric analysis

Objectives: A student should be able to know

i. Meaning of equivalent weight, molecular weight, normality, molality, primary and secondary standards.
ii. Different way to express concentrations of the solution.
iii. Preparation of standard solution.
iv. To solve numerical problems.
v. Calibrate various apparatus such as burette, pipette, volumetric flask, barrel pipette etc.
vi. Types instrumental and non instrumental analysis

Chapter 4: Non Instrumental volumetric analysis [18]

Indicators–theory of indicators, acid base indicators, mixed and universal indicators [3]

Acid–Base titrations: Strong acid–Strong base, Weak acid–strong base, Weak acid-Weak base titration, Displacement titrations, polybasic acid titrations. (Discuss titration with respect to neutralization and equivalence point determination and limitations) [6]

Redox titrations: Principle of redox titration, detection of equivalence point using suitable indicators. [3]

Complexometric titrations: Principle, EDTA titrations, choice of indicators [6]

Iodometry and Iodimetry: Principle, detection of end point, difference between iodometry and iodimetry, Standardization of sodium thiosulphate solution using potassium dichromate and iodine method, Applications – estimation of Cu , estimation of Cl_2.

Aim: To learn and equip with non instrumental volumetric techniques

Objectives: The student should able to

i. Explain role of indicators.
ii. Know mixed and universal indicators.
iii. Know neutralization curves for various acid base titration
iv. Know principle of complexometric precipitation and redox titrations.
v. Know the definitions and difference between iodometry and iodimetry.
vi. To know standardization of sodium thiosulphate and EDTA.
vii. Reactions between $CuSO_4$ and Iodine and liberated I_2 and $Na_2S_2O_3$
viii. Choice of suitable indicator.
ix. Estimate copper from $CuSO_4$ and available chlorine in bleaching powder.
x. Prepare standard silver nitrate solution.
xi. Mohr’s and Fajan’s method.
xii. Determine the amount of halides separately and in presence of each other.

Paper 4: CH-222

Section – I

Organic Chemistry

Chapter 1: Reagents in Organic Synthesis [8]

Catalytic hydrogenation including liquid phase hydrogenation, Birch reduction, $NaBH_4$, $LiAlH_4$, Sn/HCl

Oxidation reagents: $KMnO_4$, $K_2Cr_2O_7$, Jones reagent, PCC, Per acids, OsO_4.

Student should understand:

i) Concept of different reagents used in the one type of conversion

ii) Merits & demerits of different reagents

iii) Reagent based mechanisms

iv) Use of different hydrogen donors for hydrogenation

Ref. 1 & 4

Chapter 2: Chemistry of heterocyclic compounds with one hetero atom. [6]

Definition and classification of heterocyclic compounds, nomenclature and aromatic character. Synthesis of Pyrrole, Furan, Thiophene, Pyridine and their reactions: Nitration, Sulphonation, Acylation and Catalytical reduction. Structure and synthesis of quinoline and Isoquinoline.

Student should know:

i) Define and classify heterocyclic compounds.

ii) Use Huckel rule to predict aromaticity.

iii) Suggest synthetic route for preparation of various heterocyclic compounds.

iv) Write and complete various reactions of heterocyclic compounds.

v) Predict products.

Ref. 1

Chapter 3: Introduction of Bio-molecules [10]

Carbohydrates: Definition, classification, reaction of monosaccharide (glucose)- oxidation, reduction, osazone and ester formation, isomerization, Killiani-Fischer synthesis and Ruff

degradation, Configuration of D/L configuration of (+) Glucose, Fischer-Haworth and chair formulae, Brief account of disaccharides: Sucrose, cellobiose, maltose and lactose.

Polysaccharides: Starch, cellulose and glycogen.

Amino acids: Fischer projection, relative configuration, classification, structures and reactions of amino acids, Properties and chemical reactions with amino and carboxylic group.

Proteins: Formation of Peptide linkage, α-helical conformation, β-plated structure, primary, secondary, tertiary and quaternary structure of proteins.

Ref. 2 & 3

Student should know

i) Know different biomolecules.

ii) Appreciate the role of biochemistry in the day to day life.

iii) Understand the importance of biochemistry.

iv) Define carbohydrates.

v) Classify carbohydrates giving suitable examples.

vi) Write and complete various reactions of glucose.

vii) Explain optical activity in carbohydrates.

viii) Write Fischer projection and perspective formula with glyceraldehydes as reference compound.

ix) Explain the principle in Killani Fischer synthesis.

x) Explain stereoisomerism in monosaccharide.

xi) Draw structure of some common aldoses and ketoses.

xii) Distinguish between diastereomers and epimers.

xiii) Write cyclic structure of glucose in Fischer, Haworth and chair form.

xiv) Know the phenomenon of mutaroatation.

xv) Draw the structure and bonding in maltose, lactose, cellobiose and sucrose.

xvi) Know about polysaccharide, structures of starch and cellulose.

xvii) Classify the naturally occurring amino acids.

xviii) Explains the amphoteric nature of amino acids.

xix) Know the important reactions of α-amino acids.

xx) Outline the formation of peptide bond.

xxi) Explain the hydrogen bonding in α-helical structure.

xxii) Relate the stability of α-helical chain and their R-groups.

xxiii) Define primary, secondary, tertiary and quaternary structure of proteins.

xxiv) Classify proteins.

Reference Books:

Ref. 1: Organic Chemistry-6h Ed. Morrison and Boyd Prentice Hall of India Prt Ltd, New Delhi-2001.

Ref. 2: Outline of Biochemistry 5h Ed., Conn, Stumpf Bruening and Roy Doi John Wiley 1987.

Ref. 3: Stereochemistry of carbon compounds - E. L. Eliel

Ref. 4: Reactions, rearrangements and reagents – S N Sanyal

Section – II

Inorganic Chemistry

Chapter 4: Chemistry of d-block elements [6]

Position of d-block in periodic table, electronic configuration, trends in properties of these elements w.r.t.(a) size of atoms & ions (b) reactivity (c) catalytic activity (d) oxidation state (e) complex formation ability (f) colour (g) magnetic properties (h) non-stoichiometry (i) density, melting & boiling points.

Student should know:

i) To know position of d-block elements in periodic table.

ii) To know the general electronic configuration & electronic configuration of elements.

iii) To know trends in periodic properties of these elements w.r.t. size of atom and ions, reactivity, catalytic activity, oxidation state, complex formation ablility, colour, magnetic properties, non-stoichiometry, density, melting point, boiling point.

Chapter 5: Organometallic Chemistry [6]

Definition of Organometallic compounds and Organometallic chemistry, CO as a π-acid donor ligand, binary metal carbonyls, methods of synthesis; (a) Direct reaction (b) Reductive carbonylation (c) Photolysis and thermolysis. Molecular and electronic structures (18 electron rule) of metal carbonyls. Homogenous catalysis-Hydroformylation (Oxo Process) and Wacker Process.

Aim: To study the metal carbonyl complexes and their uses in the homogenous catalysis.

Objectives:

Students should be able:

i) To understand M-C bond and to define organometallic compounds

ii) To define organometallic chemistry

iii) To understand the multiple bonding due to CO ligand.

iv) To know methods of synthesis of binary metal carbonyls.

v) To understand the structure and bonding using valence electron count (18 electron rule)

vi) To understand the catalytic properties of binary metal carbonyls.

vii) To understand the uses of organometallic compounds in the homogenous catalysis.

References:

1. Concise Inorganic Chemistry by J. D. Lee-relevant pages.

2. General Chemistry-Raymond Chang- relevant pages.

Chapter 6: Acids, Bases and Solvents [6]

Definition of acids and bases, Arrhenius theory, Lowry-Bronsted theory, Lewis concept, Lux-Flood theory, strength of acids and bases, trends in the strength of hydracids and oxyacids, Properties of solvents, M.P-B.P range, dipole moment, dielectric constant, Lewis acid-base character and types of solvents.

Ref: Basic Inorganic Chemistry – F. A. Cotton (Pages- 163-173)

(6) Acids, Bases, Solvents and reactions in non-aqueous solvents:

Aims: To study different solvents and to know the different theories of acids and bases.

Objectives: A student should be able -

i) To define acids and bases according to Arrhenius theory Lowery- Bronsted concept, Lewis concept.

ii) To explain the merits and demerits of different theories of acids and bases.

iii) To define the conjugate acid and base pairs.

iv) To explain the leveling effect of solvents.

v) To demonstrate the trends in the strength of hydracids, oxyacids.

vi) To define hard and soft acids.

vii) To know the trends in the strength of hydra and oxyacids.

viii) To know the rules governing the strength of oxyacids.

ix) To explain the properties of a solvent that determines their utility.

x) To know some useful solvents.

xi) To explain the reactions in non-aqueous solvents like HF and NH3.

Chapter 7: Chemical Toxicology [6]

Toxic chemicals in the environment, Impact of toxic chemistry on enzymes.

Biochemical effect of Arsenic, Cadmium, Lead, Mercury, Biological methylation.

A student should be able -

i) To know toxic chemical in the environment.

ii) To know the impact of toxic chemicals on enzyme.

iii) To know the biochemical effect of Arsenic, Cd, Pb, Hg.

iv) To explain biological methylation.

Reference:

i) Fundamental Chemistry by A. K. Dee. (3^{rd} Ed.)

Practical Course in Chemistry CH – 223

A) Physical Chemistry practicals (Any Five)

i. To determine critical solution temperature of phenol water system

ii. To determine molecular weight of given organic liquid by steam distillation

iii. Determination of solubility of benzoic acid at different temperature and to determine ΔH of dissociation process.

iv. To study neutralization of acid (HCl) base (NaOH) and CH_3COOH by NaOH and H_2SO_4 by NaOH.

v. To determine the rate constant (or to study kinetics) of acid catalyzed ester hydrolysis.

vi. To determine the rate constant of base catalyzed ester hydrolysis.

vii. Partition coefficient of iodine between water and carbon tetrachloride.

Aim: To equip students to correlate theoretical and experimental knowledge

Objectives: After completion of practical course student should be able to

i. Verify theoretical principles experimentally

ii. Interpret the experimental data

iii. Improve analytical skills

iv. Correlate the theory and experiments and understand their importance

B) Inorganic Qualitative Analysis (Minimum Five mixtures)

i. One simple mixture (without phosphate or borate)

ii. Two Mixtures containing PO_4^{3-} (With PO_4^{3-} removal)

iii. Two Mixtures containing BO_3^{3-} (With BO_3^{3-} removal)

Inorganic Qualitative Analysis of Binary Mixtures (including phosphate and borate removal).

Sodium carbonate extract is to be used wherever necessary for detecting acidic radicals.

C) Organic Chemistry Practical

a. Organic qualitative analysis of Binary Mixtures without ether separation (**Four only**)

Two: solid-solid, one: solid-liquid, one: liquid-liquid

b. Organic Preparation: (**Any two including Crystallization, MP, TLC**)

i) Pthalic anhydride to pthalamide

ii) Glucose to osazone

iii) Acetanilide to p-bromoactanilide

iv) Benzaldehyde to dibenzylidene acetone

After completion of practical course student should be able to –

i) Verify theoretical principles experimentally.

ii) Acquire skill of crystallisation, record correct m. p. / b. p.

iii) Perform the complete chemical analysis of the given organic compound and should be able to recognize the type of compound.

iv) Write balanced equation for all the reactions, they carry in the laboratory.

v) Perform the given organic preparation according to the given procedure.

vi) Follow the progress of the reaction by using TLC technique.

vii) Set up the apparatus properly for the given experiments.

viii) Perform all the activities in the laboratory with neatness and cleanness.

Ref. 1 Organic Qualitative Analysis: A. I. Vogel

D) Analytical Chemistry Practicals (Any Five)

i. Estimation of sodium carbonate content of washing soda.
(Vogel 5thEdition: 10.30 page 295).

ii. Determination of Ca in presence of Mg using EDTA.
Ref.2: Page 412

iii. a) Preparation of standard 0.05 N oxalic acid solution and standardization of approx. 0.05N $KMnO_4$ solution.
b) Determination of the strength of given H_2O_2 solution with standard 0.05 N $KMnO_4$solution.

iv. Estimation of Aspirin from a given tablet and find errors in quantitative analysis.

v. Estimation of Al (III) from the given aluminium salt solution by using Erichrome Black–T indicator (Back titration method)

vi. Iodometric estimation of copper.

vii. Report on one day industrial educational visit.

Reference books

1. Analytical Chemistry by G.D. Christian 6th edition.
2. Vogel's Textbook of Quantitative chemical analysis 6th edition R.C. Denney, J.D. Barnes, M.J.K. Thomas

Aim: To equip students to correlate theoretical and experimental knowledge

Objectives: After completion of practical course student should be able to

i. Verify theoretical principles experimentally

ii. Interpret the experimental data

iii. Improve analytical skills

iv. Correlate the theory and experiments and understand their importance

N.B. - Industrial visit during the academic year is compulsory.

UNIVERSITY OF PUNE, PUNE.

BOARD OF STUDIES IN MATHEMATICS

Syllabus for S.Y.B.Sc

Subject: MATHEMATICS

(With effect from June 2014)

Introduction:

University of Pune has decided to change the syllabi of various faculties from June,2013.

Taking into consideration the rapid changes in science and technology and new approaches in different areas of mathematics and related subjects Board of studies in Mathematics with concern of teachers of Mathematics from different colleges affiliated to University of Pune has prepared the syllabus of S.Y.B.Sc. Mathematics. To develop the syllabus the U.G.C. Model curriculum is followed.

Aims:

i)Give the students a sufficient knowledge of fundamental principles ,methods and a clear perception of innumerous power of mathematical ideas and tools and know how to use them by modeling ,solving and interpreting.

ii) Reflecting the broad nature of the subject and developing mathematical tools for continuing further study in various fields of science.

iii)Enhancing students' overall development and to equip them with mathematical modeling abilities, problem solving skills , creative talent and power of communication necessary for various kinds of employment .

iv) Enabling students to develop a positive attitude towards mathematics as aninteresting and valuable subject of study.

Objectives:

(i) A student should be able to recall basic facts about mathematics and should be able to display knowledge of conventions such as notations, terminology and recognize basic geometrical figures and graphical displays ,state important facts resulting from their studies.

(ii) A student should get a relational understanding of mathematical concepts and concerned structures, and should be able to follow the patterns involved, mathematical reasoning.

(iii) A student should get adequate exposure to global and local concerns that explore them many aspects of Mathematical Sciences.

(iv) A student be able to apply their skills and knowledge ,that is, translate information presented verbally into mathematical form, select and use appropriate mathematical formulae or techniques in order to process the information and draw the relevant conclusion.

(v) A student should be made aware of history of mathematics and hence of its past, present and future role as part of our culture.

Eligibility: F.Y.B.Sc. ,as per University rules

Structure of the course:

	Semester I		**Semester II**	
Paper I	MT 211	Multivariable Calculus I	MT 221	Linear Algebra
Paper II	MT 212(A)	Discrete Mathematics	MT 222(A)	Multivariable Calculus II
	MT212(B)	Laplace Transform and Fourier Series	MT222(B)	Numerical methods and it's applications
Paper III	MT213	Practical based on MT211,MT212	MT223	Practical based on MT221,MT222

Paper I, Paper III is compulsory .In Paper II student can opt for ,any one of MT 212(A), MT212(B) in first semester and any one of MT221(A),MT222(B) in second semester.

In paper I and II, each course is of 50 marks (40 marks theory and 10 marks internal examination)

Paper III each course is of 50 marks(32 marks theory,8 marks oral and 10 marks internal examination)

Medium of Instruction: English

Examination:

A) Pattern of examination: Semester wise

B) Standard of passing : 20 Marks out of 50 marks for each papers.

But for passing a student should obtain minimum 16 marks out of 40 in the theory and oral examination and overall total marks for theory, oral and internal should be minimum 20.

C)**Pattern of question papers: For Paper I and Paper II**

Q1. Attempt any 05 out of 07 questions each of 02 marks. [10Marks]

Q2. Attempt any 02 out of 03 questions each of 05 marks. [10 Marks].

Q.3. Attempt any 02 out of 03 questions each of 05 marks. [10 Marks].

Q.4. Attempt any 01 out of 02 questions each of 10 marks. [10 Marks].

The pattern of question paper for Paper III

Q1.A) Attempt any 01 out of 02 questions each of 08 marks. (Based on Paper I) [08 Marks]

B) Attempt any 02 out of 03 questions each of 04 marks. (Based on Paper I) [08 Marks]

Q2. A) Attempt any 01 out of 02 questions each of 08 marks. (Based on Paper II) [08 Marks]

B) Attempt any 02 out of 03 questions each of 04 marks. (Based on Paper II) [08 Marks]

D) External Students: Not allowed.

E) Variation / Revaluation: Allowed for Paper I and II.

F) Qualifications for Teacher: M.Sc. Mathematics (with NET /SET as per existing rules)

- **Textbooks will be prepared by the BOS Mathematics, University of Pune.**

Equivalence of Previous syllabus along with new syllabus:

Semester I		**Semester II**	
New Course	**Old Course**	**New Course**	**Old Course**
MT 211 Multivariable Calculus I	MT 211 Calculus of Several Variables	MT 221 Linear Algebra	MT:221 Linear Algebra
MT 212(A) Discrete Mathematics	MT:222(B)) Discrete Mathematics	MT 222(A) Multivariable Calculus II	MT:222(A)) Vector Calculus
MT212(B) Laplace Transform and Fourier Series	MT:212(A) Differential Equations	MT222(B) Numerical methods and it's applications	MT:212(B) Numerical Analysis
MT213 Practical based on MT211,MT212	MT213 Practical based on MT211,MT212	MT223 Practical based on MT221,MT222	MT213 Practical based on MT211,MT212

Details of Syllabus:

Paper I MT 211: Multivariable Calculus I

1. **Limit and Continuity of Multivariable functions**: **[06]**
   1.1. Functions of several variables, graphs and level curves of function of two variables.
   1.2. Limit and Continuity in higher dimensions.
2. **Partial Derivatives:** **[04]**
   2.1. Definition and examples.
   2.2. Second order partial derivative, the mixed derivative theorem.
   2.3. Partial derivatives of higher order.
3. **Differentiability:** **[12]**
   3.1. Differentiability, the increment theorem for functions of two variables (without proof).
   3.2. Chain rules for composite function.
   3.3. Directional derivatives, gradient vectors.
   3.4. Tangent planes, normal lines and differentials.
4. **Extreme Values:** **[10]**
   4.1. Extreme values, First derivative test and Second derivative test for local extreme values.
   4.2. Lagrange's multipliers method for finding extreme values of constraint function (One Constraint)
   4.3. Taylors Formula for two variables.
5. **Multiple Integrals:** **[16]**

   5.1. Double Integral over rectangles, Fubini's theorem for calculating double integrals (Without proof).
   5.2. Double integrals in polar form.
   5.3. Triple integrals in rectangular coordinates.
   5.4. Triple integral in cylindrical and spherical coordinates.
   5.5. Substitution in multiple integrals, Application to area and volumes.

Text book: **Prepared by the BOS Mathematics, University of Pune.**
Recommended Book: Thomas' Calculus, 11th Edition, G. B. Thomas.
Revised by Maurice D. Weir, Joel Hass and Frank R. Giordano.
Pearson Edition 2012.
Articles: 14.1 to 14.10, 15.1, 15.3, 15.4, 15.6, 15.7

Reference Books:

1. Basic Multivariable Calculus, J. E. Marsden, A. J. Tromba , A. Weinstein, Springer Verlag (Indian Edition).
2. Shanti Narayan, R.K. Mittal, A Text-book of Vector Calculus, S.Chand and Company.
3. D.V. Widder, Advanced Calculus (2nd Edition), Prentice Hall of India ,NewDelhi,(1944).
4. T.M. Apostol , Calculus Vol. II (2nd Edition), John Wiley, New York, (1967).

Paper II(A) MT 212(A):Discrete Mathematics

1. **Logic and Proofs:** **[24]**
   - 1.1 Propositional logic.
   - 1.2 Propositional equivalences.
   - 1.3 Predicates and quantifiers.
   - 1.4 Nested quantifiers.
   - 1.5 Rules of inference.
   - 1.6 Introduction to proofs.
2. **Counting:** **[20]**
   - 2.1 The basics of counting.
   - 2.2 Permutation and combinations.
   - 2.3 Generalized permutation and combinations.
3. **Advanced Counting Technique:** **[04]**
   - 3.1 Inclusion-Exclusion (without proof).

Text book: **Prepared by the BOS Mathematics, University of Pune.**

Recommended Book:

1. Discrete Mathematics and Its Applications, Kenneth H Rosen, Seventh Edition, McGraw Hill.

Sections: 1.1 to 1.6, 5.1, 5.3, 5.5, 6.5

Reference Books:

1. Symbolic Logic, I.M. Copi, Fifth Edition, Prentice Hall of India, 1995.
2. Bernard Kolman, Robert C. Busby, Sharon Cutler Ross and Nadeem-ur-Rehman: Discrete Mathematical Structures, Fifth Edition, Pearson Education, Inc., 2004.
3. Applied Combinatorics, Fourth Edition, by Alan Tucker.

Paper II(B) MT 212(B):Laplace Transforms and Fourier Series

1. **The Laplace Transform:** **[18]**
   - 1.1 Definition, Laplace Transform of some elementary functions.
   - 1.2 Some important properties of Laplace Transform.
   - 1.3 Laplace Transform of derivatives, Laplace Transform of Integrals.
   - 1.4 Methods of finding Laplace Transform, Evaluation of Integrals.
   - 1.5 The Gamma function, Unit step function and Dirac delta function.

2. **The Inverse Laplace Transform:** [**18**]

   2.1 Definition, Some inverse Laplace Transform.

   2.2 Some important properties of Inverse Laplace Transform.

   2.3 Inverse Laplace Transform of derivative, InverseLaplace Transform of integrals.

   2.4 Convolution Theorem, Evaluation of Integrals.

3. **Applications of Laplace Transform:** [0**4]**

   3.1 Solution of Ordinary Differential Equations with constant coefficients.

4. **Fourier Series** [0**8**]

4.1Definition and examples of Fourier Series.

Text-Book: **Prepared by the BOS Mathematics, University of Pune.**

Recommended Book:

1.Schaum's Outline Series - Theory and Problems of Laplace Transform by Murray R. Spiegel. Articles 1, 2, 3.

2.Richard R. Goldberg, Methods of Real Analysis, Oxford and IBH Publishing Co. Pvt. Ltd. (1970).Art.12.1

Reference Books

1.Joel L. Schiff : The Laplace Transforms - Theory and Applications, Springer-Verlag New York 1999.

2.Dyke : An Introduction to Laplace Transforms and Fourier Series, Springer International Edition, Indian Reprint 2005.

TERM -II

Paper I MT 221: Linear Algebra

1. **Vector Spaces** **[16]**
   Definition, examples, linear dependence, basis and dimension, vector subspace, Necessary and sufficient condition for subspace, vector space as a direct sum of subspaces

2. **Inner Product Spaces** **[16]**
   Inner product, norm as length of a vector, distance between two vectors, orthonormal basis, orthonormal projection,Gram Schmidt processs of ortogonalization, null space, range space, rank, nullity, Sylvester Inequality

3. **Linear Transformations** **[16]**
   Definition, examples, properties of linear transformations, equality of linear transformations, kernel and rank of linear transformations, composite transformations, Inverse of a linear transformation, Matrix of a linear transformation, change of basis, similar matrices

Textbook: **Prepared by the BOS Mathematics, University of Pune.**

Recommended Book:

Matrix and Linear Algebra aided with MATLAB, Kanti Bhushan Datta, PHI learning Pvt.Ltd, New Delhi(2009**) (**Sections:5.1,5.2,5.3,5.4,5.5,5.7,6.1,6.2,6.3,6.4

Reference Books:

1. Howard Anton, Chris Rorres., Elementary Linear Algebra,John Wiley & Sons, Inc
2. K. Hoffmann and R. Kunze Linear Algebra, Second Ed. Prentice Hall of India , New Delhi, (1998).
3. S. Lang, Introduction to Linear Algebra, Second Ed. Springer-Verlag, New Yark.
4. A. Ramchandra Rao and P. Bhimasankaran, Linear Algebra, Tata McGraw Hill,New Delhi (1994).
5. G. Strang, Linear Algebra and its Applications. Third Ed. Harcourt Brace Jovanovich, Orlando, (1988).

Paper II (A) MT 222(A): Multivariable Calculus II

1. **Vector valued function:** **[14]**
   - **1.1** Vector valued function.
   - **1.2** Limit and Continuity of vector function.
   - **1.3** Derivative of vector function and motion.
   - **1.4** Differentiations rules.
   - **1.5** Constant vector function and its necessary and sufficient condition.
   - **1.6** Integration of vector function of one scalar variable.
   - **1.7** Arc length and unit tangent vector T. Curvature and the unit normal vector N.
2. **Line Integrals:** **[16]**
   - **2.1** Definition and evaluation of line integral.
   - **2.2** Properties of line integrals.
   - **2.3** Vector fields, work, circulation and flux across smooth curves.
   - **2.4** Path independence, Potential functions, Conservative fields.
   - **2.5** Green's theorem in plane, evaluating integrals using Green's theorem.
3. **Surface and volume integrals:** **[18]**
   - **3.1** Surface area and surface integrals.
   - **3.2** Surface integral for parameterized surfaces.
   - **3.3** Stokes theorem (without proof).
   - **3.4** The Gauss divergence theorem (proof for special regions).

Textbook: **Prepared by the BOS Mathematics, University of Pune.**

Recommended Book:

Thomas' Calculus, 11th Edition, G. B. Thomas.Revised by Maurice D. Weir, Joel Hass and Frank R. Giordano. Pearson Edition 2012.Articles: 13.1, 13.3, 13.4, 16.1 to 16.8.

Reference Books:

1. Basic Multivariable Calculus, J. E. Marsden, A. J. Tromba , A. Weinstein, Springer Verlag (Indian Edition).
2. Shanti Narayan, R.K. Mittal, A Text-book of Vector Calculus, S.Chand and Company.
3. John M. H. Olmsted, Advanced Calculus, Eurasia Publishing House, NewDelhi(1970).
4. T.M. Apostol , Calculus Vol. II (2nd Edition), John Wiley, New York, (1967).

Paper II(B) MT 222(B): Numerical Methods and its applications

1. Errors: **[4]**

1.1Errors and Their Computations
1.2 Rounding off numbers to n significant digits, to n decimal places.
1.3 Absolute, relative and percentage errors.
1.4 A general error formula.

2. Solution of Algebraic and Transcendental Equations: [10]

2.1Bisection method.
2.2The method of False position.
2.3The iteration method, Aitken's Δ^2 process
2.4 Newton- Raphson Method.

3. Interpolation: [16]

3.1Finite Difference Operators and their relations.
3.2Detection of Errors using difference table.
3.3Differences of a polynomial
3.4Newton's Interpolation Formulae (Forward and Backward)
3.5 Lagrange's Interpolation Formula
3.6 Divided differences and Newton's General Interpolation formula.

4.Least Squares Curve Fitting Procedures [4]

4.1 Fitting a Straight Line
4.2 Nonlinear curve fitting: Power function $y = ax^c$,polynomials of degree 2 and 3,Exponential function $y = cx^d$

5. Numerical Differentiation and Integration: [8]

5.1Numerical Differentiation
5.2Numerical Integration,General quadrature formula.
5.3 Trapezoidal rule.
5.4 Simpsons's $\frac{1}{3}$ rule.
5.5 Simpsons's$\frac{3}{8}$ rule.

6. Numerical solution of first order ordinary differential equations: [6]

6.1 Taylor Series method
6.2 Euler's method.
6.3 Modified Euler's methods.
6.4Runge - Kutta Methods 2^{nd} and4^{th} order.

Text Books : Prepared by the BOS Mathematics, University of Pune.

Recommended Book:

1. S.S. Sastry; Introductory Methods of Numerical Analysis, 3^{rd}edition, Prentice Hall of India.

Sections:1.3,1.4,2.1,2.2,2.3,2.4,2.5,3.3,3.4,3.5,3.6,3.9.1,3.10(3.10.1only), 4.2.1,4.2.2,5.2(excluding5.2.1,5.2.2),5.4.1,5.4.2,5.4.3, 7.2,7.4,7.4.1,7.4.2,7.5

Reference Book:

1. K.E. Atkinson; An Introduction to Numerical Analysis, Wiley Publications.

2. H.C. Saxena; Finite differences and Numerical Analysis, S. Chand and Company.

Modalities For Conducting The Practical and The Practical Examination:

1) There will be one 3 hour practical session for each batch of 12 students per week

2) A question bank consisting of 60 questions in all for each semester, distributed in two sections: 25 questions each of Paper I and Paer II will be the course work for this paper. Question Bank will be prepared by the individual subject teacher based on pattern of questions provided by university. The question bank of each year should be preserved by the subject teachers, which can be reviewed by the L.I.C. members visiting college.

3) University will conduct the Practical Examination each semester twice a year. The practical examination will consist of written examination of 32 marks and oral examination of 08 marks.

4) The practical exam will be of the duration of 3 hours duration.

5) **The pattern of question paper for Paper III**

Q1.A) Attempt any 01 out of 02 questions each of 08 marks. (Based on Paper I) [08 Marks]

B) Attempt any 02 out of 03 questions each of 04 marks. (Based on Paper I) [08 Marks]

Q2. A) Attempt any 01 out of 02 questions each of 08 marks. (Based on Paper II) [08 Marks]

B) Attempt any 02 out of 03 questions each of 04 marks. (Based on Paper II) [08 Marks]

6) Each student will maintain a journal to be provided by the college.

7)The internal 20 marks will be given on the basis of journal prepared by student and the cumulative performance of student at practicals.

8) It is recommended that concept may be illustrated using computer software and graphing calculators wherever possible.

9) Trips/Study tours may be arranged at places having important mathematical institutes or historical places.

11) Special Instruction: Before starting each practical necessary introduction, basic definitions, intuitive inspiring ideas and prerequisites must be discussed.

Faculty of Science

S. Y. B. Sc.
MICROBIOLOGY
SYLLABUS

From- A.Y. 2014-15

Equivalence of previous syllabus along with revised syllabus from A.Y. 2014-15

S.Y.B.Sc. Microbiology

EQUIVALENCE

SEMI STER	PRESENT COURSE		Revised COURSE From A.Y.2014-15	
	COURSE CODE	**COURSE NAME**	**COURSE CODE**	**COURSE NAME**
I	MB: 211	Microbial Physiology	MB: 211	Bacterial Systematics and Physiology
	MB: 212	Microbial Genetics	MB: 212	Industrial and Soil Microbiology
II	MB: 221	Bacterial Systematics and Analytical Microbiology	MB: 221	Bacterial Genetics
	MB: 222	Applied Microbiology I	MB: 222	Air and Water Microbiology
	MB: 223	Practical Course based on MB:211, MB:212, MB:221, MB:222	MB: 223	Practical Course based on MB:211, MB:212, MB:221, MB:222

Note- Practical Examination will be conducted at the end of the Second Semester.

S. Y. B. SC. MICROBIOLOGY SYLLABUS (SEM I)

MB – 211: BACTERIAL SYSTEMATICS & PHYSIOLOGY		**[48]**
I	**BACTERIAL SYSTEMATICS**	**(15)**
	a. Concept of species	2
	b. Chemotaxonomy	4
	c. Numerical taxonomy	3
	d. Genetic basis of taxonomy i. G + C content ii. DNA hybridization iii. Base sequence similarity (Use of 16s rRNA databanks)	6
II	**BACTERIAL PHYSIOLOGY**	**(20)**
	a. Radioisotopes in the study of metabolic pathways i. Autoradiography ii. Phospher imaging iii. Pulse chase (tracer studies)	3
	b. Definitions of Metabolism, catabolism, anabolism, respiration and fermentation	1
	c. Metabolic pathways (with structures) EMP, HMP, ED, Phosphoketolase, Glyoxylate, TCA (with emphasis on amphibolism), Homofermentative and heterofermentative pathways	12
	d. High Energy Compounds, Electron transport chain, Oxidative phosphorylation and Substrate level phosphorylation , Chemiosmotic hypothesis of ATP formation, Concept of Standard redox potential (Nernst equation)	4
III	**BIOCATALYSTS**	**(13)**
	a. Introduction to Enzymes: Nature of active site, ribozymes, coenzymes, apoenzymes, prosthetic group and cofactors.	3
	b. Nomenclature & classification as per IUB (up to class level).	2
	c. Structure of active site; common amino acids at active site Models for catalysis – i. Lock and key ii. Induced fit iii. Transition state.	4
	d. Specific catalytic groups involved in enzyme catalyzed reactions: Acid-base catalysis, metal ion catalysis, covalent catalysis.	1
	e. Effect of pH & temperature, substrate concentration & enzyme concentration, activators and inhibitors of enzyme	3

REFERENCES

1. Conn E., Stumpf P.K., Bruuening G., Doi RH. (1987) Outlines of Biochemistry 5th Ed , John Wiley and Sons, New Delhi. (Unit I & II)
2. Moat A.G. & Foster J.W. (1988) Microbial Physiology 2nd Ed. John Wiley and Sons New York. (Unit II & III)
3. Nelson D. L. & Cox M. M. (2005) Lehninger's Principles of Biochemistry, 4th edition, W. H. Freeman & Co. NY (Unit II & III)
4. Voet D. & Voet J. G. (1995) Biochemistry, 2nd Ed.. John Wiley & sons New York. (Unit II & III)
5. Bergey D. H. & Holt J. G. (1994) Bergey's Manual of Determinative Bacteriology. 9th Edition. Lippincott Williams & Wilkins. (Unit I)
6. Garrity G. M. (2005) Bergey's Manual of Systematic Bacteriology. 2nd Edition. (Vols. 1 – 4). Williams & Wilkins. (Unit I)
7. Madigan M. T., Martinko J. M. (2006) Brock's Biology of Microorganisms. 11th Edition. Pearson Education Inc. (Unit I, II& III)
8. Prescott L. M., Harley J. P. and Klein D. A. (2005) Microbiology, 6th Edition. MacGraw Hill Companies Inc.(Unit II)
9. Priest F. G. & Brian Austin. (1993) Modern Bacterial Taxonomy. Edn 2, Springer. (Unit I)

	MB – 212: INDUSTRIAL AND SOIL MICROBIOLOGY (48)	
I	**INTRODUCTION TO INDUSTRIAL MICROBIOLOGY**	**(22)**
	a. Strains of industrially important microorganisms: i. Desirable characteristics of industrial strain ii. Principles and methods of primary and secondary screening iii. Master, working and seed culture; development of inoculum	 1 3 2
	b. Equipment: Design of a Fermenter (typical CSTR Continuous stirred Tank Reactor); different parts and their operation.	2
	c. Process Control and Monitoring of different fermentation parameters (temperature, pH, aeration, agitation, foam)	4
	d. Types of fermentations: Batch, continuous, dual fermentations	1
	e. Media for industrial fermentations: Constituents of media ((Carbon source, nitrogen source, amino acids and vitamins, minerals, water, buffers, antifoam agents, precursors, inhibitors and inducers)	8
	f. Contamination: Sources, precautions, and consequences	1
II	**SOIL MICROBIOLOGY**	**(26)**
	a. Soil microorganisms, composition and types of soil.	2
	b. Rhizosphere microflora and its role in the rhizosphere	1
	c. Role of microorganisms in composting and humus formation	2
	d. Biofertilizers: Bacterial, Cyanobacterial ,fungal and their large scale production	3
	e. Biocontrol agents: Bacterial, Viral, Fungal and their large scale production	3
	f. Role of microorganisms in following elemental cycles in nature Carbon, Nitrogen, Sulphur, Phosphorous.	8
	g. Degradation of cellulose, hemicelluloses, lignin and pectin	3
	h**.** Brief account of microbial interactions Symbiosis, Neutralism, Commensalism, Competition, Ammensalism, Synergism, Parasitism, and Predation	4

REFERENCES:

1. Casida LE. (1984) Industrial Microbiology. Wiley Easterbs, New Delhi
2. Ingraham J. L. and Ingraham C.A. (2004) Introduction to Microbiology. 3nd Edition. Thomson Brooks / Cole.
3. Madigan M.T., Martinko J.M. (2006) Brock's Biology of Microorganisms. 11th Edition. Pearson Education Inc.
4. Modi H. A., (2008) Fermentation Technology – Volumes I and II, Pointer Publishers, Jaipur, India
5. Patel A.H. (1985) Industrial Microbiology, Macmillan India Ltd.
6. Peppler H.L. (1979) Microbial Technology, Vol I and II, Academic Press.
7. Prescott S.C. and Dunn C.G. (1983) Industrial Microbiology. Reed G. AVI tech books.
8. Salle A.J. (1971) Fundamental Principles of Bacteriology. 7th Edition. Tata MacGraw Publishing Co.
9. Martin A. Introduction to Soil Microbiology (1961) John Wiley& Sons, New York and London publication
10. Subba Rao N. S. (1977) Soil Microbiology, 4th Ed., Oxford & IBH Publishing Co. Pvt. Ltd.
11. Dubey R.C., and Maheswari, D.K. Textbook of Microbiology, S. Chand & Co.
12. Martin A. (1977) An Introduction to Soil Microbiology. 2nd edition. John Wiley & Sons Inc. New York & London.
13. Mexander M. (1977) Introduction to soil microbiology, John Wilery NY.
14. Dube H.C. and Bilgrami. K.S.(1976) Text book of modern pathology. Vikas publishing house. New Delhi.
15. Rangaswami G. (1979) Recent advances in biological nitrogen fixation. Oxford and IBH. New Delhi.
16. Stanbury P. F. and Whittaker A. (1984) Principles of Fermentation technology. Pergamon press

S. Y. B. SC. MICROBIOLOGY SYLLABUS (SEM II)

MB – 221: BACTERIAL GENETICS		**[48]**
I	**UNDERSTANDING MOLECULES OF HEREDITY**	**(10)**
	a. RNA world and shift to DNA world with time	1
	b. Discovery of transforming material (hereditary material): Griffith's experiment	1
	c. Evidence for nucleic acid as genetic material i. Avery and MacLeod experiment ii. Gierer and Schramm / Fraenkel-Conrat & Singer experiment (TMV virus) iii. Hershay& Chase experiment	3
	d. Prokaryotic genome organization	1
	e. Concept of Gene, basic structure of B form of DNA, Properties of nucleotides related with DNA stability	3
	f. Comparative account of different forms of DNA	1
II	**DNA REPLICATION AND EXPRESSION**	**(13)**
	a. DNA replication i. Messelson and Stahl's experiment (semiconservative) ii. Mechanisms of DNA replication: Theta model (semi-discontinuous), J Cairn's experiment, rolling circle model (plasmid DNA, λ phage DNA)	 2 5
	b. Gene organization and expression i. Properties of genetic code ii. Basic mechanism of transcription iii. Basic mechanism of translation	 2 2 2
III	**MUTATIONS AND REVERSIONS**	**(18)**
	a. Spontaneous mutations i. Occurrence and Mechanisms ii. Fluctuation test	2
	b. Mechanisms of induced mutations i. Base pair substitution (Transitions, Transversions), Base analogues (2amino purine, 5bromo uracil), HNO2, Alkylating agents (ethyl methyl sulphonate) ii. Frame shift mutations (Insertions and deletions), Intercalating agents (EtBr, acridine orange), Cross linking agents (Psorolin, mitomycin), UV rays, X rays, Biological mutagens (bacteriophage μ, transposomes)	10

	c. Types of mutations: Nonsense, Missense, Silent, Null, Conditional lethal-temperature sensitive, amber, leaky& non leaky	2
	d. Isolation of Mutants: Replica plate technique	1
	e. Reversion: i. True reversion ii. Suppression (intragenic and intergenic)	3
IV	**PLASMID GENETICS**	(7)
	a. Structure and Properties of plasmids	2
	b. Types of plasmids	1
	c. Plasmid replication	1
	d. Plasmid incompatibility	1
	e. Plasmid curing	1
	f. Plasmid amplification	1

REFERENCES:

1. Benjamin Lewin (1994) Genes I. Oxford University Press
2. Friefelder D. (1995) Molecular Biology, 2nd Edn. Narosa Publishing House.
3. Gardner E.J., Simmons M.J and Snustad D.P. (1991) Principles of Genetics. 8th Ed. John Wiley & Sons Inc.
4. Russel Peter. Essential Genetics. 2nd Edn, Blackwell Science Pub.
5. Stanier R.Y. (1985) General Microbiology. 4th and 5th Edn Macmillan Pub. Co. NY
6. Stent S.G. & Calender R. (1986) Molecular Genetics: An Introductory Narrative, 2nd Edition, CBS Publishers and Distributors, India.
7. Stricberger M.W. (1985) Genetics. 3rd Edition Macmillan Pub. Co. NY.
8. Watson J.D. (1987) Molecular Biology of the Gene, 4th Ed. The Benjamin Cummings Publishing Company Inc.

	MB – 222: AIR AND WATER MICROBIOLOGY (48)	
I	**AIR MICROBIOLOGY**	**(10)**
	a. Air flora i. Transient nature of air flora ii. Droplet, droplet nuclei, and aerosols	1
	b. Air pollution: Chemical pollutants, their sources in air and effects on human health	2
	c. Methods of Air sampling and types of air samplers i. Impaction on solids ii. Impingement in liquid iii. Sedimentation iv. Centrifugation v. Precipitation vi. Thermal Precipitation	4
	d. Air sanitation: Physical and chemical methods	2
	e. Air borne infections	1
II	**WATER MICROBIOLOGY**	**(38)**
	a. Types of water: surface, ground, stored, distilled, mineral and de-mineralized water	2
	b. Water purification methods, Bacteriological standards of potable water Maharashtra pollution control board (MPCB), Central pollution control board (CPCB), Bureau of Indian standards (BIS) World health Organization (WHO)	2
	c. Indicators of faecal pollution; i. *Escherichia coli* ii. *Bifidobacterium* iii. *Streptococcus faecalis* iv. *Clostridium perfringens* v. New indicators: *Campylobacter* and *Pseudomonas*	5
	d. Water borne Infections	3
	e. Bacteriological analysis of water for potability i. Presumptive coliform count ii. Confirmed test iii. Completed test iv. Eijkman test v. Membrane filter technique	6

	f. Sewage and Waste Water 1. Analysis of waste water i. Physic chemical parameters: pH, temperature, total solids, suspended solids, Chemical Oxygen Demand(C.O.D.) ii. Biological parameters: B.O.D., Toxicity (Fish bioassay) iii. Industrial water pollutants, their ecological effects and health hazards (Biomagnification and eutrophication) 2. Methods of effluent treatment – Primary, secondary, tertiary treatment methods 3. Recycling of waste water and sludge 4. Solid waste management i. Raw materials ii. Organisms involved and their activity iii. Biochemical mechanisms of Biomethanation. iv. Types of anaerobic digesters. v. Applications of biogas (Methane)	6 6 2 6

REFERENCES:

1. Daniel Lim., Microbiology, 2nd Edition; McGraw-Hill Publication
2. Ingraham J.L. and Ingraham C.A. (2004) Introduction to Microbiology. 3nd Edition. Thomson Brooks / Cole.
3. Madigan M.T, Martinko J.M. (2006) Brock's Biology of Microorganisms. 11th Edition. Pearson Education Inc.
4. Salle A.J. (1971) Fundamental Principles of Bacteriology. 7th Edition. Tata MacGraw Publishing Co.
5. Tortora G.J., Funke B.R., Case C.L. (2006) Microbiology: An Introduction. 8th Edition.
6. Stanier R.Y. (1985) General Microbiology. 4th and 5th Edn Macmillan Pub. Co. NY
7. Pelzar M. J., Chan E. C. S., Krieg N. R.(1986) Microbiology. 5th Edition, McGraw-Hill Publication
8. Prescott, Lancing M., John, P. Harley and Donald, A. Klein (2006) Microbiology, 6th Edition, McGraw Hill Higher Education
9. Hans G. Schlegel (1993) General Microbiology, 8th Edition, Cambridge University Press
10. Martin Frobisher (1937) Fundamentals of Microbiology, 8th Edition, Saunders, Michigan University press
11. Standard Methods for the Examination of Water and Wastewater (2005) 21st edition, Publication of the American Public Health Association (APHA), the American Water Works Association (AWWA), and the Water Environment Federation (WEF); edited by Andrew D. Eaton, Mary Ann H. Franson.

MB – 223: PRACTICAL COURSE BASED ON MB 211, 212, 221, 222 (27)		
1	Air sampling using an air sampler & calculation of air flora from different locations with the knowledge of respective standards of bacterial & fungal counts.	1
2	**Growth curve:** a. Absorbance measurement for bacterial culture b. Calculation of growth rate, specific growth rate and generation time c. Graph plotting by using computer software	2
3	**Measurements of cell dimension by micrometry using all the objectives**	1
4	**Bacteriological tests of potability of water** a. MPN, confirmed and completed test. b. Membrane filter technique (Demonstration)	 3 1
5	**Determination of B.O.D., total solids and total suspended solids**	2
6	**I. Biochemical characterization of bacteria:** a. Sugar utilization test (minimal medium + sugar) b. Sugar fermentation test c. IMViC d. Enzyme detection – Amylase, Gelatinase, Catalase, Oxidase e. Oxidative-fermentative test **II. Identification of Any Two bacterial isolates at least up to genus level from soil or air. (Preferably spore forming and pigmented bacteria).**	5 6
7	**Air Flora:** a. Diversity determination. b. Simpson index and settling velocity determination	**1**
8	**Primary screening of industrially important organisms:** a. Organic acid producing microorganisms OR b. Antibiotic producing microorganisms (crowded plate technique)	1
9	a. Induction of mutations by using physical mutagen (e.g. UV rays) and chemical mutagen (e.g.HNO_2) b. Isolation of mutants by any suitable method c. Demonstration of UV survival curve	3
10	**Visits to** a. Water purification plant/ b. Sewage treatment plant/Effluent treatment plant/ c. Fermentation industry	1

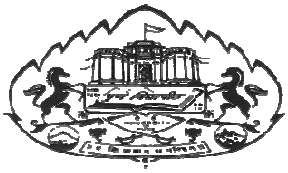
N.B.

1. Use semilog paper & computers both to plot the growth curve.
2. Visit report in the journal is mandatory.
3. Latest computer should be provided to the microbiology department.
4. 50% teaching of this practical course should be completed in Ist semester.
5. University examination will be held at the end of the IInd semester

UNIVERSITY OF PUNE

FOR

S.Y.B. Sc. (Physics)



FROM ACADEMIC YEAR

2014-2015

Equivalence of Courses in 2013 pattern with 2008 pattern

Semester I

Paper	2008 Pattern (Old Course)	2013 Pattern (New Course)
Paper I (PHY211)	Mathematical Methods in Physics I	Mathematical Methods in Physics I
Paper II (PHY 212)	Electronics I	Electronics I
Paper II (PHY 212)	Instrumentation	Instrumentation

Semester II

Paper	2008 Pattern (Old Course)	2013 Pattern (New Course)
Paper I (PHY221)	Oscillations, Waves and Sound	Oscillations, Waves and Sound
Paper II (PHY 222)	Optics	Optics

S.Y.B. Sc. (Physics)

Semester I (Paper I)

PH211: MATHEMATICAL MEHODS IN PHYSICS

Learning Outcomes: After the completion of this course students will be able to

- Understand the complex algebra useful in physics courses
- Understand the concept of partial differentiation.
- Understand the role of partial differential equations in physics
- Understand vector algebra useful in mathematics and physics
- Understand the singular points of differential equation.

1. Complex Numbers (12)

1.1 Introduction to complex numbers.
1.2 Rectangular, polar and exponential forms of complex numbers.
1.3 Argand diagram
1.4 Algebra of complex numbers using mathematical and Argand diagram
1.5 De-Moivre's Theorem
1.6 Powers, roots and log of complex numbers.
1.7 Trigonometric, hyperbolic and exponential functions.
1.8 Applications of complex numbers to determine velocity and acceleration in curved motion
1.9 Problems.

2. Partial Differentiation (12)

2.1 Definition of partial differentiation
2.2 Successive differentiation
2.3 Total differentiation
2.4 Exact differential
2.5 Chain rule
2.6 Theorems of differentiation
2.7 Change of variables from Cartesian to polar co-ordinates.
2.8 Implicit and explicit functions
2.9 Conditions for maxima and minima (without proof)
2.10 Problems.

3. Vector Algebra (06)

3.1 Introduction to scalars and vectors:
3.2 dot product and cross product of two vectors and its physical significance
3.3 Scalar triple product and its geometrical interpretation.
3.4 Vector triple product and its proof.
3.5 Problems.

4. Vector Analysis (12)

4.1 Introduction
4.2 Scalar and vector fields
4.3 Differentiation of vectors with respect to scalar.
4.4 Vector differential operator and Laplacian operator
4.5 Gradient of scalar field and its physical significance.

4.6 Divergence of scalar field and its physical significance
4.7 Curl of vector field
4.8 Vector identities
a. $\nabla x \nabla \phi = 0$
b. $\nabla.(\nabla x \mathbf{V}) = 0$
c. $\nabla.(\nabla \phi) = \nabla^2 \phi$
d. $\nabla.(\phi \mathbf{A}) = \nabla \phi. \mathbf{A} + \phi (\nabla.\mathbf{A})$
e. $\nabla X (\phi \mathbf{A}) = \phi(\nabla X \mathbf{A}) + (\nabla \phi) X \mathbf{A}$
f. $\nabla.(\mathbf{A} X \mathbf{B}) = \mathbf{B}. (\nabla X \mathbf{A}) – \mathbf{A}.(\nabla X \mathbf{B})$
4.9 Problems.

5. Differential Equation (06)
5.1 Frequently occurring partial differential equations (Cartesian coordinates)
5.2 Degree, order, linearity and homogeneity of differential equation.
5.3 Concept of Singular points. Example of singular points ($x = 0$, $x = x0$ and $x = \infty$) of differential equation.
5.4 Problems.

Additional Activity:
Four tutorials containing 10 unsolved problems each from suggested references.

Reference Books:
1. Methods of Mathematical Physics by Laud, Takwale and Gambhir
2. Mathematical Physics by B. D. Gupta
3. Mathematical Physics by Rajput and Gupta
4. Mathematical Methods in Physical Science by Mary and Boas
5. Vector analysis by Spiegel and Murrey
6. Mathematical Methods for Physicists by Arfken and Weber, 5th Edition, Academic Press.

S.Y.B. Sc. (Physics)

Semester I (Paper II)

PH212: ELECTRONICS

Learning outcomes: On successful completion of this course the students will be able to

- Apply laws of electrical circuits to different circuits.
- Understand the relations in electricity
- Understand the properties and working of transistors.
- Understand the functions of operational amplifiers.
- Design circuits using transistors and operational amplifiers.
- Understand the Boolean algebra and logic circuits.

1. NETWORK THEOREMS (06)

1.1 Kirchhoff's laws (revision)
1.2 Voltage and Current divider circuits
1.3 Thevenin's theorem
1.4 Norton's theorem
1.5 Super-position theorem
1.6 Maximum power transfer theorem (All theorems 1.3 to 1.6 with proof)
1.7 Problems.

2. STUDY OF TRANSISTOR (14)

2.1) BIJUNCTION TRANSISTOR

1. Revision of bipolar junction transistor, types, symbols and basic action
2. Configurations (Common Base, Common Emitter & Common Collector)
3. Current gain factors (α &β) and their relations.
4. Input, output and transfer characteristics of CE, CB & CC configurations.
5. Biasing methods: Base bias, Emitter feedback and voltage divider
6. DC load lines (CE), Operating point (Q point)
7. Transistor as a switch
8. Problems.

2.2) UNI- JUNCTION TRANSISTOR

1. Symbol, types, construction, working principle, I-V characteristics, Specifications, Parameters of: Uni-Junction Transistor(UJT)
2. Use of UJT as a relaxation oscillator

3. OPERTAIONAL AMPLIFIERS (10)

3.1 Introduction
3.2 Ideal and practical Characteristics
3.3 Operational amplifier: IC 741- Block diagram and Pin diagram
3.4 Concept of virtual ground
3.5 Inverting and non-inverting operational amplifiers with concept of gain.

3.6 Operational amplifier as an adder and substracter.
3.7 Problems.

4. OSCILLATROS (04)

4.1 Concept of positive and negative feedback
4.2 Barkhausein criteria for an oscillator
4.3 Construction, working and applications of
Phase shift oscillator using IC-741
4.4 Problems.

5. POWER SUPPLY (06)

5.1 Concept and working of rectifier half wave, full wave and bridge rectifier
5.2 Ripple voltage
5.3 RC filter circuit
5.4 Unregulated and regulated power supply
5.5 Concept of load and line regulation
5.6 Zener as regulator
5.7 Problems.

6. NUMBER SYSTEM AND LOGIC GATES (08)

6.1 Number systems: Binary, Binary coded decimal (BCD), Octal, Hexadecimal
6.2 Addition and subtraction of binary numbers and binary fractions using one's and two's complement.
6.3 Basic logic gates (OR, AND, NOT)
6.4 Derived gates: NOR, NAND, EXOR, EXNOR with symbols and truth tables
6.5 Boolean Algebra
6.6 De Morgan's theorems and its verification
6.7 Problems.

Reference Books:

1. Electronics Principles, Malvino, 7th Edition TaTa Mc-Graw Hills.
2. Principles of Electronics, V. K. Mehta, S. Chand Publication New Delhi.
3. Op Amp and Linear integrated circuits, Ramakant Gaikwad, Prentice Hall of India Pub.
4. Integrated Circuts, Botkar, Khanna Publications, New Delhi
5. Digital Principles and Applications, Malvino and Leech Tata Mc-Graw Hills Pub

S.Y.B. Sc. (Physics)

Semester I (Paper II)

PH212: INSTRUMENTATION

(For the students who have offered Electronic Science at F. Y. B. Sc.)

Learning outcomes: After successful completion of this course the students will be able to

- Understand the functions of different instruments.
- Use different instruments for measurement of parameters.
- Design experiments using sensors.

1. Fundamentals of measurement (08)

1.1 Aims of measurement [Ref 1, Pages: 1-2]
1.2 Functional elements of typical measurement system (block diagram and its explanation) [Ref 1, Pages: 6-8]
1.3 Standard measurements and types of calibration methods [Ref 1, Pages: 19-27]
1.4 Static characteristics (accuracy, precision, sensitivity, linearity, repeatability, reproducibility, drift, hysteresis, resolution) [Ref 1, Pages: 29-33]
1.5 Dynamic characteristics: concepts, first and second order systems, examples of first-order resistance thermometer and thermal element, examples of second order: U-tube manometer and seismic motion [Ref 1, Pages: 81-106]
1.6 Errors in measurement
1.7 Problems.

2. Transducers (12)

2.1 Measurement of displacement: variable resistance, inductance and capacitance methods. Variable capacitance transducers [Ref 1, Pages: 815-825] and Piezoelectric transducers [Ref 1, Pages: 826-829]
2.2 Measurement of force: Load cell, column type devices, cantilever beam
2.3 Measurement of temperature:
I) Scales of temperature (Kelvin, Celsius, Fahrenheit etc.)
II) Methods of temperature measurement:
a) Non-electrical method – liquid filled thermometer, bimetallic thermometer.
b) Electrical method – Platinum resistance thermometer
c) Thermistor – PTC and NTC with characteristics
d) Radiation method – Type of pyrometers, selective radiation pyrometer (solar radiation) [Ref 1, Pages: 739-758, 788-793]
2.4 Problems.

3. Measurement of pressure, flow and magnetic field (10)

3.1 Unit of pressure, concept of vacuum, absolute gauge, and differential pressure
3.2 Elastic transducer – diaphragm, corrugated diaphragm, bellows, Bourdon tube

3.3 Electric type - LVDT, strain gauge
3.4 Pressure transducer – calibration by dead weight tester method.
3.5 Problems.

4. Signal conditioning and processing (12)

4.1 OP-AMP and its characteristics (ideal and practical), basic modes of operation
4.2 OP-AMP circuit used in instrumentation – inverter, adder, subtracter, multiplier, divider, integrator, differentiator, active rectifier, comparator , logarithmic convertors, current to voltage and voltage to current converters, buffer amplifier,
4.3 Instrumentation amplifier (three OP-AMP configuration) [Ref 1, Pages: 873-903]
4.4 Filters [Ref 1, Pages: 913-918]
4.5 Problems.

5. Display, Recorders and Activators (06)

5.1 Type of recorders, graphic recorders (chart and X-T recorders),
5.2 Oscillographic recorders [Ref 1, Pages: 1034-1040]
5.3 Problems.

Ref Book:

1. A course in Electrical and Electronic Instrumentation [19th edition, 2012], A. K. Sawhney (Dhanpat Rai & Co. Pvt. Ltd., New Delhi)

Additional Reading:

1. Instrumentation devices and systems :- Rangan, Sarma, Mani [Tata Mc Graw Hill]
2. Instrumentation Measurement and Analysis – Nakra, Choudhari [Tata Mc Graw Hill]
3. Electronics Instrumentation – H.S.Kalsi [Tata Mc Graw Hill]
4. Sensor and Transducers – Patranabis [PHI]
5. Fundamental of Industrial Instrumentation- Alok Barua [Wiley India]

FOR S.Y.B. Sc. (Physics)

Semester II (Paper I)

PH221: OSCILLATIONS, WAVES AND SOUND

Learning outcomes:
On completion of this course, the learner will be able to:

- Understand the physics and mathematics of oscillations.
- Solve the equations of motion for simple harmonic, damped, and forced oscillators.
- Formulate these equations and understand their physical content in a variety of applications,
- Describe oscillatory motion with graphs and equations, and use these descriptions to solve problems of oscillatory motion.
- Explain oscillation in terms of energy exchange, giving various examples.
- Solve problems relating to undamped, damped and force oscillators and superposition of oscillations.
- Understand the mathematical description of travelling and standing waves.
- Recognise the one-dimensional classical wave equation and solutions to it.
- Calculate the phase velocity of a travelling wave.
- Explain the Doppler effect, and predict in qualitative terms the frequency change that will occur for a stationary and a moving observer.
- Define the decibel scale qualitatively, and give examples of sounds at various levels.
- Explain in qualitative terms how frequency, amplitude, and wave shape affect the pitch, intensity, and quality of tones produced by musical instruments

1. Undamped Free Oscillations (09)

1.1 Different types of equilibria (stable, unstable, and neutral equilibrium)
1.2 Potential well and periodic oscillations, Approximation of a general potential well V(x) to a parabola for small oscillations
1.3 Definition of linear and angular S.H.M.
1.4 Differential equation of S.H.M. and its solution (exponential form)
1.5 Composition of two perpendicular linear S.H.Ms. for frequencies 1:1 and 1:2 (analytical method)
1.6 Lissajous's figures and its uses, Applications (mechanical, electrical and optical)
1.7 Problems.

2. Damped Oscillations (09)

2.1 Introduction
2.2 Differential equation of damped harmonic oscillator and its solution, discussion of different cases.
2.3 Logarithmic decrement
2.4 Energy equation of damped oscillations
2.5 Power dissipation
2.6 Quality factor
2.7 Application: LCR series circuit
2.8 Problems.

3. Forced Oscillations **(10)**

3.1 Forced oscillation with one degree of freedom
3.2 Differential equation of forced oscillation and its solution (transient and steady state) Amplitude of forced oscillation
3.3 Resonance and its examples: mechanical (Barton's pendulum), optical (sodium vapour lamp),
3.4 Velocity and Amplitude resonance
3.5 Sharpness of resonance
3.6 Energy of forced oscillations
3.7 Power dissipation
3.8 Quality factor and Bandwidth
3.9 Application of forced oscillations
3.10 Equation of coupled oscillations,
3.11 Problems.

4. Wave Motion **(08)**

4.1 Differential equations of wave motion in continuous media
4.2 Equations for longitudinal waves and it's solution (one dimension only)
4.3 Equation for transverse waves and its solution (one dimension only)
4.4 Energy density and intensity of a wave
4.5 Discussion of seismic waves
4.6 Problems.

5. Doppler Effect **(06)**

5.1 Explanation of Doppler effect in sound
5.2 Expression for apparent frequency in different cases.
5.3 Asymmetric nature of Doppler effect in sound
5.4 Doppler effect in light, symmetric nature of Doppler effect in light.
5.5 Applications: Red shift, Violet shift, Radar,
5.6 Problems.

6. Sound **(06)**

6.1 Definition of sound intensity, loudness, pitch, quality and timber
6.2 Acoustic intensity level measurement
6.3 Acoustic pressure and it's measurement
6.4 Reverberation time and Reverberation of a hall
6.5 Sabine's formula (without derivation)
6.6 Stroboscope
6.7 Problems

Reference Books:

1. Waves and Oscillations, Stephenson
2. The physics of waves and oscillations, N. K. Bajaj, Tata McGraw- Hill, Publishing co. ltd.
3. Fundamentals of vibration and waves, SPPuri,Tata McGraw-Hill Publishing co. ltd.
4. A text book of sound, Subramanyam and Brijlal, Vikas Prakashan
5. Sound, Mee, Heinmann, Edition - London
6. Waves and Oscillations, R.N. Chaudhari, New age international (p) ltd.

S.Y.B. Sc. (PHYSICS)

SEMESTER II (PAPER II)

PH222: OPTICS

Learning Outcomes

This course will enable you to:

- acquire the basic concepts of wave optics
- describe how light can constructively and destructively interfere
- explain why a light beam spreads out after passing through an aperture
- summarize the polarization characteristics of electromagnetic waves
- appreciate the operation of many modern optical devices that utilize wave optics
- Understand optical phenomena such as polarisation, birefringence, interference and diffraction in terms of the wave model.
- analyse simple examples of interference and diffraction phenomena.
- be familiar with a range of equipment used in modern optics.

1. Geometrical Optics: (10)

1.1 Introduction
1.2 Lenses: thin and thick
1.3 Sign convention
1.4 Thin lenses: lens equation
1.5 Lens maker equation
1.6 Magnification of thin lens
1.7 Deviation by thin lens
1.8 Power of thin lens
1.9 Equivalent focal length of two thin lenses
1.10 Cardinal points
1.11 Problems.

2. Lens Aberrations (10)

Introduction
Types of aberration: Monochromatic and chromatic
Types of monochromatic aberrations and their reductions
Types of chromatic aberrations
Achromatism : lenses in contact and separated by finite distance
Problems.

3. Optical Instruments (10)

3.1 Introduction
3.2 Simple Microscope
3.3 Compound Microscope
3.4 Ramsdens eye piece
3.5 Huygens eye piece

3.6 Problems.

4. Interference and Diffraction (12)

4.1 Revision to Interference
4.2 Phase change on reflection (Stokes Treatment)
4.3 Interference by parallel sided thin films
    4.3.1 Interference due to reflected light
    4.3.2 Interference due to refracted light
4.4 Interference due to Wedge Shaped thin film
4.5 Types Diffraction : Fresenel's diffraction and Fraunhoffer's diffraction
4.6 Fraunhoffer's diffractions at a double slit
4.7 Plane diffraction grating
4.8 Newton's Rings
4.9 Rayleigh's criterion for resolution
4.10 Problems.

5. Polarization (06)

5.1 I ntroduction
5.2 Brewster's law
5.3 Law of Malus
5.4 Polarization by double refraction.
5.5 Nicol prism.
5.6 Problems.

Reference Books:

1. Optics, fourth edition, Pearson education, E. Hetch, A. R. Genesan
2. A Text book of Optics, N.Subhramanyam, Brijlal, M. N. Avadhanulu, S. Chand publication.
3. Physical Optics by A.K.Ghatak, McMillan, New Delhi
4. Fundamental of Optics, F.A.Jenkins, H.E.White, McGraw-Hill international Edition.
5. Principles of optics, D.S. Mathur, Gopal Press, Kanpur

S. Y. B. Sc. (PHYSICS)

PAPER III (SEMESTER I and II)

PH223: PRACTICAL COURSE

Learning Outcomes

- After completing this practical course students will be able to
- Use various instruments and equipment.
- Design experiments to test a hypothesis and/or determine the value of an unknown quantity.
- Investigate the theoretical background to an experiment.
- Set up experimental equipment to implement an experimental approach.
- Analyse data, plot appropriate graphs and reach conclusions from your data analysis.
- Work in a group to plan, implement and report on a project/experiment.
- Keep a well-maintained and instructive laboratory logbook.

Section I:

1) Oscillations, Waves and Sound (Any 4 experiments)

1. Logarithmic decrement (in air and water)
2. Study of coupled oscillators comprising two simple pendulum (Mechanical) and determination of coupling coefficient.
3. Study of musical scales using a signal generator and musical instruments.
4. Determination of frequency of AC mains using sonometer.
5. Measurement of coefficient of absorption of sound for different materials (cork, thermocol, mica, paper etc.)
6. Velocity of sound by phase shift method.
7. Determination of speed of sound by Quincke's method interferometer.
8. Directional characteristics of Microphone.

2) Optics (Any 4 experiments)

1. Newton's Ring: Determination of wavelength of monochromatic light source (λ)
2. Dispersive power of glass prism
3. Total internal reflection (using a LASER beam and glass prism).
4. Diffraction at the edge of a razor blade.
5. Optical activity of sugar solution (polarimeter)
6. Goniometer to determine cardinal points and focal length.
7. To determine temperature of sodium flame.
8. Double refracting prism.

Section II:

1) Electronics/Instrumentation (Any 6 experiments)

1. Circuit Theorems. (Thevenin's, Norton's and Maximum power transfer theorem)
2. Transistor characteristics (CE configuration):

3. Transistor amplifier (single stage)
4. Study of rectifiers (half wave and full wave) with different filters.
5. I-V characteristics of UJT
6. UJT as a Relaxation Oscillator.
6. Zener as a regulator, line and load regulation.
7. Study of Phase shift oscillator (using IC 741)
8. OPAMP as inverting and non inverting amplifier
9. OPAMP as an audio mixer.
10. Study of logic gates (using IC) and verification of De Morgan's theorem.
11. Use of CRO (AC/DC voltage measurement, frequency measurement).
12. To measure displacement (linear and angular) using potentiometer/variable inductor/variable capacitor.
13. To measure force using load cell.
14. To measure pressure using elastic diaphragm (in variable Capacitor/Bourden Tube)
15. To measure magnetic field using Hall probe for a system of ring magnets.

2) Computer (2 experiments)

1. Plotting various trigonometric functions using spreadsheet/any graphic softwares: sinx, cosx, tanx, e^{x}, e^{-x}, logx, lnx, x^{n} and
2. equations for the following figures: circle, ellipse, parabola, hyperbola.
3. Inverse, determinant of matrix, solution of linear equations.

Additional Activities (Any Two)

1. Demonstrations- Any 4 demonstrations equivalent to 2 experiments
2. Study tour with report equivalent to 2 experiments
3. Mini project equivalent to 2 experiments
4. Computer aided demonstrations (Using computer simulations or animations)(Any

Demonstrations equivalent to 2 experiments)

Students have to perform at least two additional activities in addition to sixteen experiments mentioned above. Total laboratory work with additional activities should be equivalent to twenty experiments.