

St. Xavier's College (Autonomous),
Mumbai



Syllabus of the courses offered by the
Department of Botany
(2018-19)

**Department of Botany,
St. Xavier's College (Autonomous), Mumbai**



Syllabus for the First year B.Sc.

Program: Botany

Courses: S.BOT.1.01, S.BOT.1.02

Semester: I

(Credit Based Semester and Grading System)

P. A. N. S.

APPROVED SYLLABUS

H. H. H.
16/04/18
HEAD OF DEPARTMENT
DEPT. OF BOTANY
ST. XAVIER'S COLLEGE
(AUTONOMOUS)
MUMBAI - 400 001

DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (AUTONOMOUS), MUMBAI.		
Course Code	Paper Title	Lectures
S.BOT.1.01	PLANT DIVERSITY- I	
LEARNING OBJECTIVES: The students will be able to learn		
<ul style="list-style-type: none"> • Understand the morphology, structure and importance of the organisms. • State the meaning of scientific terms. • Differentiate between various groups of Algae, Fungi, Lichens and Bryophyte. 		
UNIT I: ALGAE: General characters of Algae, Pigments in Algae, Classification of Algae into 4 major classes - Cyanophyta, Chlorophyta, Phaeophyta and Rhodophyta; General characters of these classes, and Economic importance of Algae, Type studies: Distribution, life cycle and systematic position of <i>Nostoc</i> , <i>Spirogyra</i> .		15
UNIT II: FUNGI: General characters of Fungi, Classification: Phycomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes, General characters of these classes: Mode of nutrition in Fungi, Economic importance of Fungi, Type studies: Distribution, lifecycle and systematic position of <i>Rhizopus</i> , <i>Agaricus</i> .		15
UNIT III: BRYOPHYTA: General characters and classification of Bryophytes: Hepataceae, Anthocerotaceae and Musci; Type studies; Distribution, life cycle and systematic position of <i>Riccia</i> . Economic importance of Bryophytes		15
CIA- multiple choice questions / test / assignments / puzzles / quizzes / field study report.		
Practicals- Course: S. BOT PR 1.01		
<ol style="list-style-type: none"> 1. Study of Economically Important Algae and Fungi. 2. Study of stages in the life cycle of <i>Nostoc</i>, <i>Spirogyra</i>. 3. Collection and identification of Algae from the field. 4. Study of stages in the life cycle of <i>Rhizopus</i> and <i>Agaricus</i>. 5. Study of the life cycle of <i>Riccia</i>. 		
Practical skeleton question paper		
Duration: 3 hr		Total Marks: 50
Q.1. Identify, classify and describe the specimens A and B.		16
Q.2. Identify and describe specimen C.		12
Q.3. Comment on the economic importance of specimens D, E, F and G.		12
Q.4. Viva voce		05
Q.5. Journal		05
Reference Books:		
<ol style="list-style-type: none"> 1. Smith, Gilbert M; Cryptogamic Botany Algae & Fungi Volume 1; 2nd edition; McGraw-hill book Comp. Tokyo, 1955. 2. Vasishtha B.R. And A. K. Sinha- Botany for degree students Part 1 ALGAE; S. Chand & Company Ltd, 1st edition, revised 2005. 3. Smith, Gilbert M; Cryptogamic Botany Bryophyta & Pteridophyta Volume 2; 2nd edition; McGraw-hill book Comp. Tokyo, 1955. 		

P. Anurag

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Shinde
16/10/18
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MUMBAI - 400 001.

DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (AUTONOMOUS), MUMBAI.		
Course Code	Paper Title	Lectures
S.BOT.1.02	ANGIOSPERMS- I	
LEARNING OBJECTIVES: The students will be able to learn		
<ul style="list-style-type: none"> • Understand the morphology, structure and functions of various parts of plants. • Learn the taxonomical terminology and understand the meaning of the same. • Learn anatomical structure and functions of various tissues. 		
UNIT I: MORPHOLOGY OF ANGIOSPERMS: Leaf: parts, simple and compound leaves, Inflorescence: types; Flower.		15
UNIT II: ANGIOSPERMS TAXONOMY: Introduction to Systems of Classification – Artificial, Natural and Phylogenetic, Bentham and Hooker's system of classification, Study of following families: Leguminosae, Asteraceae, Amaryllidaceae.		15
UNIT III - ANATOMY- PRIMARY STRUCTRES: Tissue systems in plants: Epidermal, ground and vascular tissue systems; Simple and compound tissues: Parenchyma, Collenchyma, Sclerenchyma, Xylem and Phloem; Study of Primary structures: Dicot and monocot stem.		15
CIA- multiple choice questions / test / assignments / puzzles / quizzes / field study report.		
Practical Course: S.BOT.PR.1.02		
<ol style="list-style-type: none"> 1. Study of morphological characters of leaf, inflorescence and flower. 2. Primary structure of typical dicot and monocot stem. 3. Study of families prescribed in theory (any one plant species available from each family). 4. Field excursion. 		
Practical skeleton question paper		
Duration: 3hr		Total Marks:50
Q.1. Assign specimen A and B to their respective families giving reasons. Sketch and label diagrams.		22
Q.2. Mount epidermal outgrowths / stomata C from given specimen.		06
Q.3. Identify and describe specimen D, E, F and G.		12
Q.4. Viva voce		05
Q.5. Journal		05
Reference Books:		
<ol style="list-style-type: none"> 1. Dutta, A. C.; A Classbook of Botany; 15th edition; Calcutta: Oxford University Press, 1976. 2. Sivarajan, V. V.; Introduction to the principles of plant taxonomy; 2nd edition; Cambridge: Cambridge University Press, 1991. 3. Subrahmanyam, N. S.; Modern plant taxonomy; New Delhi: 1st edition; Vikas Publishing House Pvt. Ltd., 1995. 4. Lawrence, George H. M.; Taxonomy of Vascular Plants; 1st edition; New Delhi: Oxford & IBH Publishing Co., 1967. 5. Sharma, O. P.; Plant Taxonomy; 1st edition, reprint; New Delhi: Tata Mcgraw-Hill 		

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**Department of Botany,
St. Xavier's College (Autonomous), Mumbai**



Syllabus for the Second year B.Sc.

Program: Botany

Courses: S.BOT.3.01, S.BOT.3.02, S.BOT.3.03

Semester: III

(Credit Based Semester and Grading System)

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16/04/2018
HEAD OF DEPARTMENT
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ST. XAVIER'S COLLEGE
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DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (AUTONOMOUS), MUMBAI.		
Course Code	Paper Title	Lectures
S.BOT.3.01	PLANT DIVERSITY- II	
LEARNING OBJECTIVES: The students will be able to learn		
<ul style="list-style-type: none"> • Understand the importance of bacteria and methods of their cultivation. • Learn about the causal organisms of plant diseases. • Learn the life cycles of the individuals belonging to Algae, Fungi and Lichens. 		
Unit I: MICROBIOLOGY: Basics principles of staining; culture media preparation; pure culture methods: Classification of bacteria based on mode of nutrition; Biofertilizers and methods of application; Bacteria in sulphur cycle; Bacteria in Phosphate solubilization.		15
Unit II: ALGAE AND LICHENS: Algae: Structure, life cycle and systematic position of <i>Vaucheria</i> , <i>Sargassum</i> , <i>Batrachospermum</i> .; Lichens - Classification, structure, method of reproduction and ecological significance.		15
Unit III: FUNGI AND PLANT PATHOLOGY: Fungi- Structure, life cycle and systematic position of <i>Puccinia</i> and <i>Phytophthora</i> ; Diseases, symptoms, disease cycle and control measures of rust of wheat and late blight of potato.		15
CIA- multiple choice questions / assignments / presentation / field report / test.		
Practicals- Course: S.BOTPR.3.01		
<ol style="list-style-type: none"> 1. Sterilization techniques, preparation of nutrient agar. 2. Preparation of slants and plates, Study of streak plate method. 3. Gram staining of bacteria. 4. Effect of plant extract (Turmeric / Garlic) on microbial growth by agar diffusion method. 5. Study of stages in the life cycle of <i>Vaucheria</i>, <i>Sargassum</i>, <i>Batrachospermum</i> and diatoms. 6. Structure of crustose, foliose and fruticose lichens and their reproductive structures. 7. Study of diseases, (a) rust of wheat (<i>Puccinia</i>) (b) late blight of potato (<i>Phytophthora</i>). 		
Practical skeleton question paper		
Duration: 3hr		Total Marks: 50
Q.1. Microbiology experiment A.		10
Q.2. Identify, classify and describe the specimens B, C and D.		18
Q.3. Identify and describe specimens E, F and G. (spots)		12
Q.4. Viva voce		05
Q.5. Journal		05
Reference Books:		
<ol style="list-style-type: none"> 1. Gupta, P.K.; Cytogenetics; 1st edition, reprint; Meerut: Rastogi Publications, 2004. 2. Gupta, P.K.; Genetics: A textbook for University students; 3rd edition; Meerut : Rastogi Publications , 2007. 3. Gardner, Eldon J.; Snustad, Peter D.; Principles of genetics; 7th edition; New York: John Wiley & Son , 1984. 4. De Robertis, E. D. P.; Nowinski, Wiktor W.; Saez, Francisco A.; Cell Biology; Philadelphia: W.B. Saunders Company, 1970. 5. Powar, C. B.; Daginawala, H. F.; General microbiology; vol. I-II; 2nd edition, reprint; Bombay: Himalaya Publishing House, 1986 (1993) 6. Subrahmanyam, N. S.; Sambamurty, A. V. S. S.; Ecology; 1st edition; New Delhi: Narosa Publishing House, 2000. 7. Sharma, P. D.; Ecology and Environment; 7th edition; Meerut: Rastogi Publishers, 1998. 		

**Department of Botany,
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Syllabus for the Second year B.Sc.

Program: Botany

Courses: S.BOT.3.01, S.BOT.3.02, S.BOT.3.03

Semester: III

(Credit Based Semester and Grading System)

P. A. N. S.
APPROVED SYLLABUS

H. K. D.
16/04/2018
HEAD OF DEPARTMENT
DEPT. OF BOTANY
ST. XAVIER'S COLLEGE
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DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (AUTONOMOUS), MUMBAI.		
Course Code	Paper Title	Lectures
S.BOT.3.02	PLANT PHYSIOLOGY AND BIOCHEMISTRY- II	
LEARNING OBJECTIVES: The students will be able to understand;		
<ul style="list-style-type: none"> • The importance of minerals to plants, • The catabolic process and synthesis of chemical energy in plants, the anabolic process in plants. • Differentiate between light and dark reactions of photosynthesis. • The respiratory process in presence of light and differentiate between C3, C4 and CAM plants 		
Unit I: RESPIRATION: Respiratory substrates, Nature of biological oxidation, Glycolysis, Oxidative pentose phosphate pathway, Anaerobic respiration, Tricarboxylic Acid Cycle, Respiratory chain, Significance of ATP.		15
Unit II: PHOTOSYNTHESIS: Efficiency of plants in converting radiant energy and matter, Light reaction of photosynthesis, Chloroplast as the unit of photosynthesis, Reaction scheme for ATP and NADPH formation, Role of ATP and NADPH in CO ₂ fixation, Path of carbon in photosynthesis – C3, C4 and CAM, Factors influencing photosynthesis.		15
Unit III: PHOTORESPIRATION AND MINERAL NUTRITION: Photorespiration: Biochemistry of photorespiration in C3 plants and C4 plants, Mineral nutrition: Autotrophs and heterotrophs, Essential elements, criteria of essentiality of elements, Nutritional disorders of plants, Sources of nutrients, Mycorrhiza in plant mineral nutrition.		15
CIA- multiple choice questions / test / assignment.		
Practicals- Course: S.BOT.PR.3.02		
<ol style="list-style-type: none"> 1. Estimation of Ca²⁺ and Mg²⁺ in plant sample. 2. Estimation of phosphorous in plants. 3. Colorimetric estimation of total chlorophyll content. 4. Estimation of carotenoids from plant samples. 5. Separation of photosynthetic pigments by TLC. 6. Solvent extraction of chlorophyll pigments and study of its absorption spectrum 7. Study of Kranz anatomy. 		
Practical skeleton question paper		
Duration: 3hr		Total Marks: 50
Q.1. Perform the physiology experiment A allotted to you.		24
Q.2. Perform and comment on the given experiment B.		16
Q.3. Viva voce		05
Q.4. Journal		05
Reference Books:		
<ol style="list-style-type: none"> 1. Noggle, Ray G.; Fritz, George J.; Introductory plant physiology; 2nd edition; New Delhi : Prentice-Hall Of India Private Limited , 1991. 2. Sinha, B. K.; Pandey, S. N.; Plant Physiology; 1st edition; New Delhi: Vikas Publishing House Pvt. Ltd., 1981. 3. Verma, V.; Textbook of plant physiology; New Delhi: Ane Books India, 2007. 4. Salisbury, Frank B.; Ross, Cleon W.; Plant physiology; 3rd edition, Reprint; New Delhi: CBS Publishers & Distributors, 1986 (2001). 5. Devlin, Robert M.; Witham, Francis H.; Plant Physiology; 4th edition, Indian reprint; Delhi: CBS Publishers & Distributors, 1986 (2001). 6. Kochhar, P.L.; A textbook of Plant Physiology; 7th edition; Delhi: Atma Ram & Sons, 1964. 7. Verma S. K. Textbook of Plant physiology and Biochemistry; 4th editon; S. Chand & Company Ltd, 2003. 		

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16/04/18

DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (AUTONOMOUS), MUMBAI.		
Course Code	Paper Title	Lectures
S.BOT.3.03	ANATOMY, EMBRYOLOGY & PALYNOLOGY	
LEARNING OBJECTIVES: The students will be able to learn		
<ul style="list-style-type: none"> • Differentiate between the normal and anomalous secondary growth. • Learn about the different meristems their locations and functions. • Learn the developmental stages of micro and megasporangium. • Understand the pollen morphology and the applications of palynology. 		
Unit I: ANATOMY: Normal secondary growth in Dicotyledonous stem and root, Anomalous secondary growth in the stems of <i>Bignonia</i> , <i>Salvadora</i> , <i>Achyranthes</i> and <i>Dracaena</i> ; Anomalous secondary growth in the roots of Beet and Radish, Root stem transition, Study of apical, lateral and root meristems		15
Unit II: EMBRYOLOGY: Structure of Microsporangium, microsporogenesis and development of male gametophyte, Structure of Megasporangium, megasporogenesis, and development of female gametophyte, Double fertilization and its significance, Development of embryo – Dicotyledonous– <i>Capsella</i> type.		15
Unit III: PALYNOLOGY: Pollen and spore morphology- size and shape, polarity, apertures, exine stratification, construction of palynogram.; Application of palynology in honey industry, coal and oil exploration, forensic sciences, pollen allergy.		15
CIA- assignments / presentation / moodle / test.		
Practicals- Course: S.BOT.PR.3.03		
<ol style="list-style-type: none"> 1. Study of normal secondary growth in sunflower stem and root. 2. Study of anomalous secondary growth in the stems of <i>Bignonia</i>, <i>Salvedora</i>, <i>Achyranthus</i>, and <i>Dracaena</i> by double staining technique and preparation of permanent slide using one of the above materials. 3. Study of anomalous secondary growth in the storage roots of Beet and Radish. 4. Study of apical, lateral and root meristem using slides / photomicrographs. 5. Study of various stages of microsporogenesis, megasporogenesis and embryo development with the help of permanent slides / photomicrographs 6. Study of pollen morphology of <i>Hibiscus</i>, <i>Canna</i>, <i>Panocratium</i> and <i>Ocimum</i>. 7. Pollen analysis from honey sample: Unifloral and Multifloral honey. 		
Practical skeleton question paper		
Duration: 3hr	Total Marks: 50	
Q.1. Perform the palynology experiment A allotted to you.	07	
Q.2. Cut the T.S. of material B to show anatomical features.	12	
Q.3. Cut the T.S. of material C to show anomalous secondary growth.	12	
Q.4. Identify and describe D, E and F.	09	
Q.5. Viva voce	05	
Q.6. Journal	05	
Reference Books:		
<ol style="list-style-type: none"> 1. Eames, Arthur J.; MacDaniels, Laurence H.; An introduction to plant anatomy; 2nd edition. Reprint; New Delhi: Tata Mcgraw-Hill Publishing Company Limited, (1978, 2004) 2. Esau, Katherine; Anatomy of seed plants; 2nd edition; New York: John Wiley & Sons, 1977. 3. Gangulee, Das, and Dutta – College Botany Vol I. 4. Fahn, A; Plant anatomy; 4th edition. Indian reprint; New Delhi: Aditya Books (P) Ltd., 1990(1997) 5. Maheshwari, P.; Introduction to the embryology of angiosperms; 2nd edition, reprint; New 		

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Allunde
16/06/18

**Department of Botany,
St. Xavier's College (Autonomous), Mumbai**



Syllabus for the Third year B.Sc.

Program: Botany

Courses: S.BOT.5.01, S.BOT.5.02

Semester: V

(Credit Based Semester and Grading System)

Alfonso
16/04/18

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DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (AUTONOMOUS), MUMBAI.		
Course Code	Paper Title	Lectures
S.BOT.5.02	ANGIOSPERMS- III	
LEARNING OBJECTIVES: The students will be able to understand;		
<ul style="list-style-type: none"> • Taxonomic Terminology. • Various classification systems and the reasoning behind the same. • Learn various plant families and their economic importance. 		
UNIT I: ECONOMIC AND MEDICINAL BOTANY: Timber Yielding Plants. Oil Yielding Plants. Dye Yielding plants, Beverages- tea, coffee. Botanical name, family, part used and uses of plants in these categories.		15
UNIT II: PLANT SYSTEMATICS-I - CLASSIFICATION SYSTEMS: Study of the various classifications systems: Cronquist, Takhtajan and APG I-III; Introduction to botanical nomenclature (ICBN), Conservation: methods of Plant Conservation, Botanical Survey of India – Its role in conservation of Biodiversity, IUCN – Red data book		15
UNIT III: PLANT SYSTEMATICS-II - ANGIOSPERM FAMILIES: Study of the following families – emphasis to be given on its peculiar characteristics and economic importance, their systematic position as per Bentham and Hooker's system of classification. Current position according to APG III System. Capparidaceae, Sterculiaceae, Tiliaceae, Solanaceae, Asclepiadaceae, Acanthaceae, Verbenaceae, Zingiberaceae, Cannaceae, Musaceae and Poaceae		15
UNIT IV: BIODIVERSITY: Definition, Levels of Biodiversity. Importance and status of biodiversity. Loss of Biodiversity – reasons; measures to conserve the biodiversity. Distribution of Flora found in various forest types of India. Biodiversity Act, 2002.		15
CIA- multiple choice questions / assignments / presentation / field excursion and report / test / literature review and preparation of project proposal.		
Practical - Course: S.BOTPR.5.02 1. Morphology and Identification of timber yielding plants. 2. Morphology and Identification of oil yielding plants 3. Morphology and Identification of dye yielding plants. 4. Morphology, Identification, Botanical name, Family and uses of Tea and Coffee plants / products. 5. Study of the following families: Minimum two species each from the families prescribed in theory. 6. Identification of Genus and Species: At least three specimens from any families prescribed in the theory for FYBSc to TYBSc. 7. Field excursion.		
Practical skeleton question paper Duration: 3hr Q.1. Identify giving morphology and state economic importance of specimen A and B. Q.2. Classify the specimen C and D upto their families giving reasons. Give floral formula, sketch and label L.S. of flower and T.S. of ovary.		Total Marks: 50 12 20

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Q.3. Identify the genus and species of the specimen using flora.	08
Q.4. Viva voce	05
Q.5. Journal	05
Reference Books:	
1. Dutta, A.C., A Class book of Botany. 15 th edition. Calcutta. Oxford Univ. Press 1976.	
2. Simpson M. G. Plant Systematics 2 nd , Academic Press, 2010.	
3. Sivarajan, V.V. Introduction to the principles of plant taxonomy 2 nd ed. Cambridge Univ. Press. 1995.	
4. Stuessy Tod F., Plant Taxonomy: The Systematic Evaluation of Comparative Data. Columbia Univ. Press. 2008.	
5. Barry g. Hall, Phyogenetic tree made easy - How to ... Manual 3rd ed.	
6. Phillippe Lemey, Macro Salemi, Anne-Mieke Vandamme, Phylogenetic Handbook - A practical approach to phylogenetic analysis and hypothesis testing -	
7. Singh Gurucharan, Plant Systematics – Theory and Practice 3 rd edition 2010.	

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DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (AUTONOMOUS), MUMBAI.		
Course Code	Paper Title	Lectures
S.BOT.5.01	CYTOGENETICS, MOLECULAR BIOLOGY & BIOTECHNOLOGY	
LEARNING OBJECTIVES: The students will be able to understand; <ul style="list-style-type: none"> • The mechanism, role and importance of cell division, linkage and crossing over. • The various gene mutations, their adverse effects in man and advantages in plant breeding. 		
UNIT I: INHERITANCE AND MOLECULAR BIOLOGY: Cytoplasmic Inheritance- Streptomycin sensitivity in <i>Chlamydomonas</i> , CO ₂ sensitivity in <i>Drosophila</i> (sigma factor); Plastid inheritance - variegation in <i>Mirabilis jalapa</i> ; Male sterility in plants. Petite colonies in yeast. DNA- Central dogma of protein synthesis, Transcription, Genetic code, Translation.		15
UNIT II: MUTATION: Gene Mutations: Types - somatic / germ line, spontaneous / induced, gross / point - base pair substitutions - transversion, transition; Effect of substitution mutation on the phenotype - Missense, Nonsense, Neutral, Silent mutations. Chromosomal Mutations - Structural and Numerical changes in Chromosomes; Role of mutations in plant breeding and crop improvement.		15
UNIT III: Biotechnology I Nucleic acids modifying enzymes – ligase, restriction endonucleases, Polymerases, Kinases, phosphatases, reverse transcriptase; Vectors used in gene cloning – plasmids, phages, cosmids, YAC and BAC; Methods of gene transfer - physical, chemical and biological.		15
UNIT IV: Biotechnology II Methods of gene identification in organisms, Gene libraries, Restriction mapping, Methods of DNA amplification and sequencing, southern hybridization, clonal hybridization.		15
CIA- multiple choice questions / assignment / presentation / test/ literature review and preparation of project proposal.		
Practicals- Course: S.BOT.PR.5.01		
<ol style="list-style-type: none"> 1. Study Identification of cloning vectors, Ti plasmid for production of transgenic plants. 2. Study of inheritance pattern with reference to plastid inheritance. 3. Quantitative estimation of plant genomic DNA 4. Quantitative estimation of plant genomic plant RNA. 5. Isolation of onion DNA using agarose gel electrophoresis. 6. Determining the sequence of amino acids in the protein molecule synthesized from the given m-RNA strand (prokaryotic and eukaryotic). 		
<i>Practical skeleton question paper</i>		
Duration: 3hr		Total Marks: 50
Q.1. Perform smear preparation for meiosis / estimation of DNA / estimation of RNA of given material A.		10
Q.2. Perform tetrad analysis / three point test cross of the given material B.		10
Q.3. Determine the DNA sequence / amino acid sequence in a protein molecule with the help of given data.		10
Q.4. Identify and describe the specimen D.		07
Q.5. Viva voce		08

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MUMBAI - 400 001.

Reference Books:

1. Concepts of Genetics W. S. Klug, M. R. Cummings, C. A. Spencer. 8 Edition, Pearson Education International (2006)
2. Introduction to Genetic Analysis A. J. Griffiths, S. R. Wessler, R. C. Lewontin, S. B. Carroll. 9th Edition, Freeman and Company (2008)
3. Molecular Biology of the Gene J. D. Watson, T. A. Baker, S. P. Bell, A. Gann, M. Levine, R. Losick. 5th Edition, Pearson Education (2004)
4. Principles of Genetics P. Snustad, M. Simmons, 4th Edition, John Wiley and Sons Co., (2006)
5. Genetics: A Conceptual Approach B. Pierce, 3rd Edition, Freeman & Co., (2008)
6. iGenetics Peter Russell, 2nd Edition, Pearson International, (2006)
7. Gupta, P.K. (1990). Genetics. Rastogi Publications
8. Principles of Genetics Tamarin 7th Edition
9. Cell biology by Bruce Alberts
10. Molecular Biotechnology: Principles and Applications of Recombinant DNA by Bernard R. Glick and Jack J. Pasternak

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Alvinda
7/6/18
HEAD OF DEPARTMENT
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MUMBAI - 400 001.

**DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE
(AUTONOMOUS), MUMBAI.
(Syllabus 2018-2019)**

**Course Code
SBOT0201**

**Paper Title
PLANT PHYSIOLOGY AND BIOCHEMISTRY- I**

LEARNING OBJECTIVES

The students will be able to understand

- The transport mechanism in plants, the physiological processes and their importance.
- The mechanism of enzyme actions.
- The major classes of organic compounds, their synthesis and breakdown in plants.

UNIT I : WATER RELATIONS

(15 Lectures)

Water as a plant constituent, Functions of water in plants, Water molecule, Physical and chemical properties of water, Imbibition and osmosis, Water potential and its components, Role of turgor pressure in plant cells, Changes in Ψ_p and Ψ_w during reversible changes in cell volume. Transpiration and absorption: Water loss by transpiration, Measurements of transpiration rates, Movement of water vapor through stomatal pores, Plant antitranspirants, Stomatal movements, Absorption of water by absorbing plants, Movement of water across roots and through leaves.

UNIT II : TRANSPORT PROCESSES

(15 Lectures)

Transport processes: Movement of solutes in plants, Passive transport, Protoplasmic membrane, Active transport across protoplasmic membranes, Mechanism of active transport, Shuttle systems, Electroosmosis and pinocytosis, Transcellular transport, Translocation in sieve tubes, Anatomy of sieve tubes, Mechanism of sieve tube translocation.

UNIT III : PLANT BIOCHEMISTRY

(15 Lectures)

Enzymes: Nomenclature, Properties, Classification, Specificity, Apoenzyme, prosthetic group, Mode of action, Kinetics (no derivation of Michaelis Menten equation), Enzyme inhibition, Isozymes. Major Cellular compounds: carbohydrates, lipids and proteins, their classification and functions in plants; biosynthesis and degradation of Fats.

CIA- multiple choice questions / test / assignments / puzzles / quizzes / field study report/ Outstation seminar.

Practicals- Course: SBOTPR0201

1. Study of activity of amylase.
2. Determination of solute potential by plasmolytic method.
3. To demonstrate ascent of sap using a dye.
4. Demonstration of transpirational water loss by Ganong's potometer.
5. Determination of stomatal frequency.
6. Qualitative analysis for detection of Carbohydrates.
7. Tests for detection of proteins and amino acids.
8. Tests for detection of fats and oil.

Reference Books:

1. Noggle, Ray G.;Fritz, George J.; Introductory plant physiology; 2nd edition; New Delhi : Prentice-Hall Of India Private Limited , 1991.
2. Sinha, B.K.;Pandey, S.N.; Plant Physiology; 1st edition; New Delhi : Vikas Publishing House Pvt. Ltd. , 1981.
3. Salisbury, Frank B.;Ross, Cleon W.; Plant physiology; 3rd edition, Reprint; New Delhi : CBS Publishers & Distributors , 1986(2001).
4. Devlin, Robert M.;Witham, Francis H.; Plant Physiology; 4th edition, Indian reprint; Delhi : CBS Publishers & Distributors , 1986(2001).
5. Kochhar, P.L.; A textbook of Plant Physiology; 7th edition; Delhi :Atma Ram & Sons , 1964.
6. Verma S. K. Textbook of Plant physiology and Biochemistry ; 4th editon; S. Chand & Company Ltd, 2003.

**DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE
(AUTONOMOUS), MUMBAI.
(Syllabus 2018-2019)**

**Course Code
SBOT0202**

**Paper Title
CYTOLOGY, GENETICS & ECOLOGY**

LEARNING OBJECTIVES

The students will be able to understand

- The structure and functions of various cell organelles.
- The phenomenon of inheritance.
- The interactions taking place in the ecosystem and flow of Energy.

UNIT I: CYTOLOGY

(15 Lectures)

Ultra-structure and functions of the following: Cell wall, Plasma membrane (unit membrane and fluid mosaic model), Mitochondrion and Chloroplast, Nucleus: Chromosomes, Cell division – Mitosis.

UNIT II : GENETICS

(15 Lectures)

Mendel's Laws, Allelic and non-allelic interaction, Epistatic interactions, Sex determination in plants.

UNIT III : ECOLOGY

(15 Lectures)

Concept of Ecosystem: Components and their interactions, Food Chains and food web Ecological pyramids; Ecological adaptations of plants belonging to following ecological groups: Hydrophytes, Xerophytes and Halophytes.

CIA- multiple choice questions / test / assignments / puzzles / quizzes.

Practicals- Course: SBOTPR0202

1. Examining various stages of mitosis in root tip cells.
2. Observation of polytene chromosomes in salivary glands of *Chironomus* larvae.
3. Study of external and internal structures of *Hydrilla*, *Nymphaea*, *Nerium*, *Opuntia* and *Avicennia*.
4. Study of pond, terrestrial and estuarine ecosystem.
5. Problems on Mendelian genetics- Mono hybrid and dihybrid ratios, Allelic and non-allelic interactions, Epistatic interactions

Reference Books:

1. Gupta, P.K.; Cytogenetics; 1st edition, reprint; Meerut: Rastogi Publications, 2004.
2. Gupta, P.K.; Genetics : A textbook for University students; 3rd edition; Meerut : Rastogi Publications, 2007.
3. Gardner, Eldon J.; Snustad, Peter D.; Principles of genetics; 7th edition; New York : John Wiley & Sons , 1984.
4. De Robertis, E.D.P.; Nowinski, Wiktor W.; Saez, Francisco A.; Cell Biology; Philadelphia : W.B. Saunders Company , 1970.
5. Powar, C.B.; Daginawala, H.F.; General microbiology; vol.I-II; 2nd edition, reprint; Bombay : Himalaya Publishing House , 1986(1993)
6. Subrahmanyam, N.S.; Sambamurty, A.V.S.S.; Ecology; 1st edition; New Delhi : Narosa Publishing House , 2000.

**DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE
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(Syllabus 2018-2019)**

**Course Code
SBOT0401**

**Paper Title
PLANT DIVERSITY- III**

LEARNING OBJECTIVES: The students will learn

- The life cycles of the individuals belonging to Bryophyta, Pteridophyta and Gymnosperms.
- The geological time periods and the plants of past.
- The different methods of fossilization.

Unit I: BRYOPHYTA (15 Lectures)

Classification of Bryophyta up to class; Salient features of Hepaticae, Anthocerotae and Musci; Structure, life cycle and systematic position of *Marchantia*, *Anthoceros* and *Funaria*; Thallus organization in Bryophyta, Apogamy and apospory in Bryophytes.

Unit II: PTERIDOPHYTA (15 Lectures)

Classification of Pteridophyta up to class; Salient features of Psilophyta, Lepidophyta, Calamophyta and Pterophyta, Structure, life cycle and systematic position of *Selaginella*, *Equisetum* and *Adiantum*; Heterospory and origin of seed.

Unit III: GYMNOSPERMS AND PALAEOBOTANY (15 Lectures)

Classification of Gymnosperms up to class; Structure, life cycle and systematic position of *Cycas* and *Gnetum*; Economic importance of Gymnosperms. Palaeobotany- Geological time scale, fossil formation; Birbal Sahani Institute of Paleobotany, Lucknow; Study of Form Genera- *Lepidodendron*, *Lyginopteris*.

CIA- multiple choice questions / assignments / presentation / test.

Practicals- Course: SBOTPR0401

1. Study of stages in the life cycle of *Anthoceros* and *Marchantia*.
2. Study of stages in the life cycle of *Funaria*.
3. Study of stages in the life cycle of *Selaginella*.
4. Study of stages in the life cycle of *Equisetum*, *Adiantum*.
5. Study of stages in the life cycle of *Cycas*.
6. Study of stages in the life cycle of *Gnetum*.
7. Study of form genus *Lepidodendron*, *Lyginopteris*.

Reference Books:

1. Vasishta B.R. And A. K. Sinha- Botany for degree students: Bryophyta; S. Chand & Company Ltd,
1st edition, revised 2005.
2. Vasishta B.R. And A. K. Sinha- Botany for degree students: Pteridophyta; S. Chand & Company Ltd, 1st edition, revised 2005.

3. Smith, Gilbert M; Cryptogamic Botany Bryophyta &Pteridophyta Volume 2; 2nd edition; McGraw hill book Comp. Tokyo, 1955.
4. Parihar, N.S.; Pteridophytes : An introduction to embryophyta, vol.II; 4th edition; Allahabad, Central Book Depot , 1962.
5. Kar, Ashok Kumar;Gangulee, Hirendra Chandra; College botany: Volume II; 2nd edition; Kolkata: New Central Book Agency (P) Ltd , 1989, 2006.
6. Dutta, A.C.; A Classbook of Botany; 15th edition; Calcutta: Oxford University Press, 1976.
7. Rashid, A.; An introduction to Bryophyta : Diversity, development and differentiation; 1st edition; New Delhi : Vikas Publishing House Pvt. Ltd., 1998.
8. Chamberlain, Charles Joseph; Gymnosperms : structure and evolution; 2nd edition; New York Dover Publications, Inc. , 1966.
9. Rashid, A.; An introduction to pteridophyta : diversity and differentiation; 4th edition; New Delhi: Vikas Publishing House Pvt. Ltd. , 1982.

**DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE
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(Syllabus 2018-2019)**

**Course Code
SBOT0402**

**Paper Title
ANGIOSPERMS- II**

LEARNING OBJECTIVES: The students will learn

- The taxonomical terminology and understand the meaning of the same.
- The various classification systems and understand the reasoning behind the same.
- Basics of Nomenclature

Unit I: MORPHOLOGY AND ECONOMIC BOTANY (15 Lectures)

Morphology of fruits; Economic botany: fiber yielding plants, paper yielding plants, spices and condiments.

Unit II: ANGIOSPERM FAMILIES (15 Lectures)

Study of the following angiosperm families as per Bentham and Hooker's System emphasising peculiar structures found in plants and economic importance of these species: Anacardiaceae, Rutaceae, Combretaceae, Myrtaceae, Apiaceae, Rubiaceae, Euphorbiaceae, Apocynaceae, Arecaceae.

Unit III: LITERATURE AND HERBARIUM TECHNIQUES (15 Lectures)

Taxonomic structure; Major and Minor Categories; Taxonomic Literature; Characters of Taxonomic importance – Anatomy, Palynology and Embryology. Herbarium – Blatter Herbarium; techniques used in preparation of herbarium specimens.

CIA- moodle / assignment / presentation / field report / test.

Practicals- Course: S.BOTPR.4.02

1. Study of Fruit morphology.
2. Study of two anatomical, palynological and embryological characters of taxonomic importance to
3. distinguish any two families.
4. Study of the following families, their morphological peculiarities and economic importance: Anacardiaceae, Rutaceae, Combretaceae, Myrtaceae, Apiaceae, Rubiaceae, Euphorbiaceae, Apocynaceae, Arecaceae.
5. Visit to Blatter Herbarium and preparation of a report on the same.
6. Field excursion.

Reference Books:

1. Dutta, A.C.; A Classbook of Botany; 15th edition; Calcutta: Oxford University Press, 1976.
2. Sivaraman, V.V.; Introduction to the principles of plant taxonomy; 2nd edition; Cambridge: Cambridge University Press , 1991.
3. Subrahmanyam, N.S.; Modern plant taxonomy; New Delhi : 1st edition; Vikas Publishing House Pvt. Ltd. , 1995.
4. Lawrence, George H.M.; Taxonomy of Vascular Plants; 1st edition; New Delhi : Oxford &Ibh Publishing Co., 1967.
5. Sharma, O.P.; Plant Taxonomy; 1st edition, reprint; New Delhi : Tata Mcgraw-Hill Publishing Co. Ltd. , 1993(2002)
6. Singh, Gurcharan; Plant systematics : theory and practice; 2nd edition; New Delhi : Oxford &Ibh Publishing Co. Pvt. Ltd. , 2004;
7. Naik, V.N.; Taxonomy of angiosperms; 1st edition; New Delhi :
8. Chamberlain, Charles Joseph; Coulter, John Merle; Morphology of Angiosperms Delhi
9. Subhash Chandra Datta; A handbook of Systematic Botany; 1st edition;

**DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE
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**Course Code
SBOT0403**

**Paper Title
MEDICINAL BOTANY AND TOOLS OF ANALYSIS**

LEARNING OBJECTIVES The students will learn

- The methods of evaluation of crude drugs and the adulterants used.
- The working and use of instruments in plant science.
- The important websites and databases available on the internet.
- To compare the significant difference/s in 2 or more samples.

Unit I: MEDICINAL BOTANY (15 Lectures)

Kampoh and ayurvedic system of medicine, and modern classification of crude drugs, Pharmacognosy- definition and scope; Analytical Pharmacognosy – drug adulteration, methods of drug evaluation, phytochemical investigations; Bio-prospection of plant species in relation to medicinal plants; Plants used in treatments of various ailments – Ginger, Turmeric, Tulsi, Garlic, Cinnamon, Nutmeg, Clove; Herbal cosmetics.

Unit II: INSTRUMENTATION (15 Lectures)

Principle, working and applications of pH meter, colorimeter; Light, phase contrast, scanning electron and transmission electron microscopy; Chromatography - Paper, thin layer and column chromatography; Gel electrophoresis.

Unit III: BIOSTATISTICS AND BIOINFORMATICS (15 Lectures)

Frequency distribution- graphical representation, distribution of data in Biology; Standard deviation; Descriptive statistics, Testing of hypothesis: Student's t-test (paired and unpaired) and Correlation. Introduction to bioinformatics, tools used in bioinformatics related to biotechnology; NCBI data models and other data bases, services offered by NCBI and EBI.

CIA- assignments / presentation / project / test.

Practicals- Course: S.BOTPR.4.03

1. Determination of swelling factor; and extractive values of crude drugs.
2. Organoleptic study, macroscopic and microscopic characters of plant drug- Leaf drug *Adhoda vasica*; Rhizome drug *Zingiber officinale*; Bark drug *Cinnamomum zylanicum*.
3. Preliminary tests for alkaloids, tannins and glycosides.
4. Study of plants used in various ailments: Ginger, Turmeric, Tulsi, Garlic, Cinnamon, Nutmeg, Clove.
5. Separation of carotenoids by column chromatography(Demonstration).
6. Measure of central tendency, frequency distribution and Standard deviation and t –test analysis.
7. Use of BLAST, and MSA.

Reference Books:

1. Mahajan, B.K.; Methods in biostatistics; 6th edition; New Delhi: Jaypee Brothers, 1997.
2. Kandavel, D.;Pandian, T.T.; Textbook of biotechnology; 1st edition; New Delhi: I.K. International Publishing House Pvt. Ltd , 2008.
3. Kokate, C.K.;Purohit, A.P.;Gokhale, S.B.; Pharmacognosy; 39th edition; Pune : NiraliPrakashan ,

2007.

4. Ignacimuthu, S.; Basic bioinformatics; 4th editon; New Delhi: Narosa Publishing House , 2005.
5. Rastogi, Veer Bala.; Fundamentals of Biostatistics; 2nd edition, reprint; New Delhi : Ane Books India , 2006(2008).
6. Qadry, J.S.; Pharmacognosy; 16th edition; N.A. : Author , 2010.
7. Trease, George Edward;Evans, William Charles; Pharmacognosy; 11th edition; London : Cassell& Company Ltd. , 1978.
8. Chatwal, Gurdeep R.;Anand, Sham K.; Instrumental methods of chemical analysis : Analytical chemistry; 5th edition. / ed. by M.Arora and Aseem Anand; Mumbai : Himalaya Publishing House ,2002.
9. Bennett, Alva H.;Osterberg, Harold;Jupnik, Helen;Richards, Oscar W.; Phase microscopy : principles and applications; 1st edition; New York : John Wiley & Sons, Inc., 1951.

**DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE
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Course Code Paper Title
SBOT0601 PLANT PHYSIOLOGY AND BIOCHEMISTRY- III

LEARNING OBJECTIVES

The students will be able to understand

- The biochemical steps involved in nitrogen assimilation in plants and will be able to differentiate between the process of inorganic and organic nitrogen fixation.
- The phenomenon of transformation of vegetative axis into reproductive axis and the substances responsible for this transformation.
- The process of seed germination and know the factors which facilitate the germination and the physiology of fruit ripening.
- The time measuring mechanism in plants. The aging process in plants.

UNIT I: FERTILIZERS AND NITROGEN METABOLISM (15 Lectures)

Assimilation of inorganic nutrients- NPK fertilizers, N₂ cycle. Reduction of nitrate, Assimilation of ammonia, Biological nitrogen fixation, Biochemistry of biological nitrogen fixation, Effects of nitrogen assimilation on carbohydrate utilization. Phosphate and cation assimilation.

UNIT II: PLANT GROWTH (15 Lectures)

Vegetative growth- Definition, Quantitative aspects of growth of annual plants, Factors affecting growth; Reproductive growth- Initiation of flower primordial, Environment and flower initiation (photoperiodism and vernalization), Florigen.

UNIT III: PLANT GROWTH SUBSTANCES (15 Lectures)

Plant growth substances: biosynthesis, physiological role and practical applications of following: Auxins, Gibberellins, Cytokinins, Ethylene and physiology of fruit ripening, Absciscic acid-Growth retarding chemicals and Brassinosteroids.

UNIT IV: PHYSIOLOGY OF SEEDS, AGING; BIOLOGICAL CLOCK (15 Lectures)

Seed development, Seed germination, Morphological and biochemical changes accompanying seed development and seed germination, Dormancy. Aging and senescence; Biological clock.

CIA- short answers question / assignment / presentation / problem solving / project / test.

Practicals- Course: SBOTPR0601

1. To study the activity of nitrate reductase.
2. To estimate the α -amino nitrogen.
3. To estimate the total protein content by Lowry's method.
4. Separation of amino acids by circular paper chromatography.
5. Separation of Fatty acids by TLC.
6. Inhibition of seed germination by inhibitors in fruit juices.
7. Mobilization of starch during seed germination by amylases (qualitative)

Reference Books:

1. Noggle, Ray G.;Fritz, George J.; Introductory plant physiology; 2nd edition; New Delhi : Prentice-Hall Of India Private Limited , 1991.
2. Sinha, B.K.;Pandey, S.N.; Plant Physiology; 1st edition; New Delhi : Vikas Publishing House Pvt. Ltd. , 1981.
3. Verma, V.; Textbook of plant physiology; New Delhi : Ane Books India , 2007.
4. Salisbury, Frank B.;Ross, Cleon W.; Plant physiology; 3rd edition, Reprint; New Delhi : CBS Publishers & Distributors , 1986(2001).
5. Devlin, Robert M.;Witham, Francis H.; Plant Physiology; 4th edition, Indian reprint; Delhi : CBS Publishers & Distributors , 1986(2001).
6. Kochhar, P.L.; A textbook of Plant Physiology; 7th edition; Delhi :Atma Ram & Sons , 1964.
7. Verma S. K. Textbook of Plant physiology and Biochemistry ; 4th editon; S. Chand & Company Ltd, 2003.
8. Noggle, Ray G.;Fritz, George J.; Introductory plant physiology; 2nd edition; New Delhi : Prentice-Hall Of India Private Limited , 1991.
9. Salisbury, Frank B.;Parke, Robert V.; Vascular plants : form and function; London : Macmillan & Co Ltd , 1964.
10. Sinha, R.K.; Modern plant physiology; 2nd edition; New Delhi :Narosa Publishing House , 2004.
11. Taize and Zigger, Plant physiology

**DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE
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(Syllabus 2018-2019)**

Course Code **Paper Title**
SBOT0602 **ECOLOGY AND ENVIRONMENTAL BOTANY-I**

LEARNING OBJECTIVES:

The students will be able to understand

- The role and importance of biotic and abiotic environmental factors in the sustenance of plant life.
- Causes, consequences, prevention, remediation of pollution and efforts taken in reducing or controlling the pollution causing factor.
- The importance of phytogeography and forestry for man and the legal enforcement imposed by government in preventing the loss to the natural regional flora.

UNIT I: ABIOTIC FACTORS **(15 Lectures)**

Light- quality, duration, absorption, intensity, effects on plants; Temperature- variation due to altitude, effects on plants, thermal constant and stratification; Water- Precipitation, moisture, measurement of rainfall. Wind - speed, advantages and damage caused to plants. Soil- soil profile, texture, classification, moisture, water, organic matter, atmosphere, temperature, organisms.

UNIT II: BIOTIC INTERACTIONS **(15 Lectures)**

Biotic community relationships- mutualism, mycorrhizae, commensalisms, proto cooperation, competition, amensalism and saprophytes. Prey-predation Model equation.

UNIT III: POLLUTION **(15 Lectures)**

Causes of Pollution: Light, Noise, Water, Soil and Air.

Effect of pollution on plants: Light, Noise, Water, Soil and Air.

Mitigation of pollution by plants: Noise, Water, Soil and Air.

UNIT IV: FORESTRY **(15 Lectures)**

Types of forests, destruction of forests, deforestation, afforestation, reforestation, institutions for forest research, education and training; Biosphere reserves. Forest Conservation act, 1980; Environment Protection Act 1986; The Indian Wildlife (Protection) Act – 1972 amended 1991.

CIA- assignment / presentation / field report / open book test/ Case study.

Practicals- Course: SBOTPR0602

1. Study of ecological instruments i.e. lux meter, rain guage, hygrometer, wet and dry bulb thermometer, wind anemometer, maximum and minimum thermometer, barometer.
2. To study the chemical characters (moisture, carbonate, nitrate, base deficiency, pH of soil by use of rapid tests.
3. Determination of salinity and chlorinity of water sample.
4. Estimation of organic matter and organic carbon from soil.
5. Determination of percent leaf area injury of different infected leaf samples.
6. Determination of BOD in water sample.
7. Identification of Phytogeographical area from map with respect to distribution, rainfall and vegetation.

Reference Books:

1. R.S. Ambast - A text book of plant ecology.
2. Fundamental of Ecology (1971): EP Odum; WB Saunders Company.
3. Jogdand, SN 1995. Environmental Biotechnology. Himalaya Publishing House, Mumbai.
4. Ecology and environment; PD Sharma, Rastogi publications, Meerut. 7th ed – 2004.
5. Environmental chemistry by B. K. Sharma, Goel publication house, Meerut, Sixth revised edition – 2001.
6. Ecology- N.S. Subrahmanyam and A.V.S.S. Sambamurty, Narosa Publishing House, 2000;
7. Environmental Chemistry, A. K. Day, Fourth Edition, New Age International Publishers- 2002
8. Environmental Science; by-Santra SC; Central Publ. New Delhi.