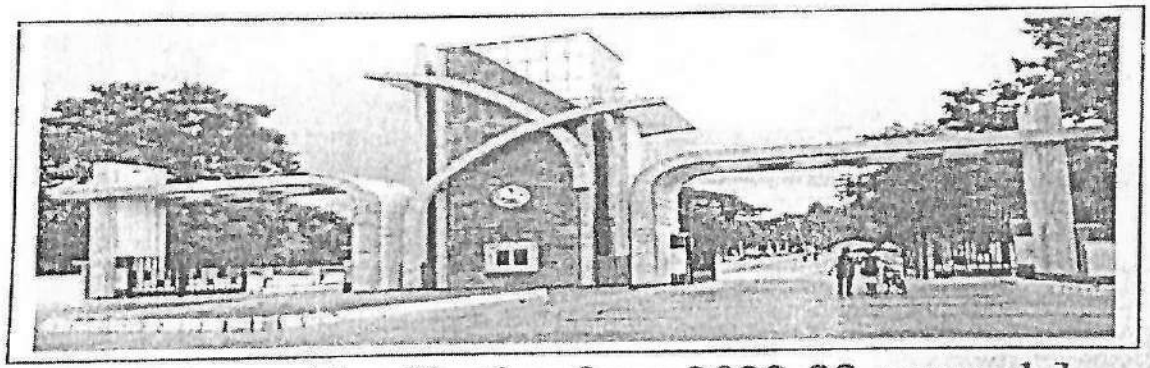
SAMBALPURUNIVERSITY
JYOTI-VIHAR, BURLA

FACULTYOFSCIENCE

SYLLABUS

M.Sc. (BOTANY)

(CBCS Pattern)



[Syllabus with effective from 2022-23 onwards]

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Deptt. Of Botany
Govt. Women's College, SBP

Controller of Examinations
Sambalpur University

APPROVED

VICE CHANCELLOR

ABREIFINTRODUCTIONOFTHEPROGRAMME

Program Outcome: M.Sc. in Botany

M.Sc. in Botany is a two years regular course, offered by P.G. department of Botany. Sambalpur University. The present syllabus covers different components of theoretical and practical, as well as project work, field study and seminar presentations, which will help the students to get in depth knowledge on advanced Botany. During and the completion of this course, students are expected to have an overall knowledge on Microbiology, different lower (Cryptogams) and higher plants (Phanerogams) diversity, their anatomy, physiology, biochemistry, biostatistics, reproductive biology, genetics, evolutionary history and Palcobotany etc. The students can learn about the erigis and history of different cultivated plants, their economic importance, utilization and conservation of natural resources different renewable and nonrenewable energy sources. The course curriculum is designed to introduce the students about sensory biology and stress physiology along with the hands on training on the theory and practical aspects of different instruments along with microbial and plant tissue culture. The course also encompasses an enriched knowledge on Ecology, environmental pollutions and different Environment laws. After completion of this course, students are expected to have practical knowledge on how to handle and operate basic instruments for their experimental purposes. They might have basic idea on experimental designing, project handling and writing their project reports, which may be beneficial for them in future and improve their capability to write notes and research articles for different scientific journals. The degree of M.Sc. Botany may open their path into academia/research career at national and international level as a scientist, as a teaching faculty or as a scholar or into different administrative positions.

Course Outcome

After successful completion of this course, students will be able to understand, the cell structures in relation to function of cells, the fundamental unit of life along with molecules present in cells, the concepts in prokaryotic eukaryotic, and viral genetics, the central dogma of molecular biology (replication, transcription, and translation), the types of mutation, gene regulation and transposable element, the diversity of lower cryptogams (Algae, Fungi Bacteria, and viruses), the collection and study of algae, fungi, bacteria from different natural sources, the identification up to generic level. After completion of the course the students will be familiar with various physiological aspects involved in the plant development, the role of enzymes in it and mechanism of photosynthesis respiration, nitrogen and lipid metabolism. Identification of genus and species of locally available wild plants preparation of botanical keys at generic level by locating key characters, knowledge of at least 10 medicinal plan species, the study of at least 20 locally available families of flowering plants and knowledge of secondary metabolite and its use in taxonomy, development of plant reproductive parts i.e. male, female gametophytes and fruit Sterilization techniques for media as well as for explants and their culture, anther culture, pollen culture.

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SEMESTER-WISECOURSESTRUCTUREFORTHETWOYEARSP.GPROGRAMMEIN UNIVERSITY P.G DEPARTMENT AND COLLEGES UNDER SAMBALPURUNIVERSITY

TO BEEFFECTIVEFROM 2022-2024

For MSc Botany (ScienceDept)			
	FromtheDepartment		
Semester	Credit		Credit
First	20	Environmental Studies and Disastermanagement	2
Second	20	InterDept.Course(IDC)oropen elective	3
Third	20	EntrepreneurshipDevelopment	2
Fourth(includingproject of4credit)	20		
TOTAL	80	MOOCsonepaper(inIIndor IIIrdSem)	3
Totalcreditfor 2years course =90 Credits			
Furthermorefollowingnon-creditcoursewillbetakenbythestudents			
1.YuvaSanskar		2.N.C.C/N.S.S/Sports/Performing Arts/Yoga(Ofwhichonehastobeopted)	

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M.Sc. BOTANY

(Effective from the Session 2022-2024) 2023-25-

OUTLINEOFTHECOURSE

PAPER	COURSE TITLE	CREDITS (CH)	MARKS		
			End term	Midterm	Total
	SEMESTER I				
BOT-101	Microbial Diversity	4	80	20	100
BOT -102	Diversity of Cryptogams and Gymnosperm	4	80	20	100
BOT -103	Biochemistry	4	80	20	100
BOT -104	Analytical Techniques	4	80	20	100
BOT -105	Practical	4	100		100
	Total credit hours/marks for First semester	**20**	**420**	**80**	**500**
	SEMESTER II				
BOT -201	Systematics of Angiosperm	4	80	20	100
BOT -202	Plant Physiology and Metabolism	4	80	20	100
BOT -203	Cell and Molecular Biology	4	80	20	100
BOT -204	Ecology and Biostatistics	4	80	20	100
BOT -205	Practical	4	100		100
	Total credit hours/marks for Second semester	**20**	**420**	**80**	**500**
	SEMESTER III				
BOT -301	Plant Embryology and Anatomy	4	80	20	100
BOT -302	Genetics, Plant Breeding and Evolution	4	80	20	100
BOT -303	Plant Pathology	4	80	20	100
BOT -304	Natural Resource, Conservation and Utilization	4	80	20	100
BOT -305	Practical	4	100		100
	Total credit hours/marks for Third semester	**20**	**420**	**80**	**500**
	SEMESTER IV				
BOT -401	Advance Plant Biotechnology	4	80	20	100
BOT -402	Environmental Biotechnology	4	80	20	100
	Elective Paper (Students have to Choose any one)				
BOT -403E-A	Phytomedicine	4	80	20	100
BOT -403E-B	Molecular Stress Biology	4	80	20	100
BOT -404	Environment and Waste Management	4	50+30	20(Interim)	100
BOT -405	Project, Seminar Presentation, Field Study, Scientific visit	4	100		100
	Total credit hours/marks for Fourth semester	**20**	**420**	**80**	**500**
	Grand Total	**80**	**1680**	**320**	**2000**
BOT -IDC	Mushroom Cultivation	3			

n all the practical examinations10marks will meant for seminar presentation and seminar report preparation.

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SEMESTER I

PAPER: BOT101

MICROBIAL DIVERSITY

100 marks (80+20)

4 CH

Unit-I:

Bacteria and Archaea: Classification, cell structure, nutrition, growth, reproduction, Economic importance. Bacterial genetics: plasmid and episome, conjugation, transduction and transformation. Cyanobacteria: Classification, cell structure, nutrition, reproduction, cellular differentiation, heterocyst and its function. Economic importance of cyanobacteria,

Unit-II:

Virus: General properties, structure, purification, cultivation, principle of viral taxonomy, classification, one step growth experiment and lifecycle, Animal virus and their reproduction, Plant virus and their transmission. Economic importance of viruses, Viriods and Prions, Bacteriophage

Unit-III:

Algae: Distribution (terrestrial, freshwater, marine); thallus organization; cell structure; criteria for classification of algae; pigments, reserve food, flagella, reproduction (vegetative, asexual, sexual). Salient features of Chlorophyta, Euglenophyta, Charophyta, Xanthophyta, Bacillariophyta, Phaeophyta and Rhodophyta. Economic importance of algae. Algal blooms and toxins, algae as biofertilizer, food, feed, and uses in industry.

Unit- IV:

Fungi: General characters of fungi; substrate relationship in fungi; cell ultra-structure, unicellular and multicellular organization; nutrition (saprobic, biotrophic, symbiotic) reproduction (vegetative, asexual, sexual); heterothallism; heterokaryosis; parasexuality; recent trends in classification. Phylogeny of fungi. General account of Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina. Fungi in industry, medicine and food, Fungi as biocontrol agent, Mycorrhizae, Lichen.

Select text books for reading:

Prescott, L. M., Harley, J. P. and Klen, D. A. (1999). Microbiology, 7th Ed., McGraw-Hill, New York.

Pelczar, Jr., M. J., Chan E.C.S. and Krieg, N. R. (2005). Microbiology, 5th Ed, Tata McGraw-Hill. New Delhi.

Alexopoulus, C. J., Mims, C. W. and Blackwel, M. (1996). Introductory Mycology, John Wiley, New York. Kumar, H. D. (1988). Introductory Phycology. East-West Press, New Delhi.

Maloy, S. R., Cronan, J. E. Jr. and Freifielder, D. (2008). Microbial Genetics, 2nd Ed. Norosa, New Delhi.

Mehrotra, R. S. and Aneja, R. S. (1998). An Introduction to Mycology, New Age International, New Delhi.

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PAPER: BOT102

DIVERSITY OF CRYPTOGAMS AND GYMNOSPERM

100 marks (80+20)

4 CH

Unit-I:

BRYOPHYTA: Morphology, origin, structure, reproduction and life history. Distribution, classification, Comparative study of Marchantiales, Jungermaniales, Anthocerotales, Sphagnales, Funariales and Polytrichales. Ecological importance, phylogeny of Bryophytes.

Unit- II:

PTERIDOPHYTA: Morphology, origin, anatomy and reproduction; classification; evolution of stele; heterospory and origin of seed habit. General account of morphology and reproduction of Psilopsida, Lycopsida: Sphenopsida and Pteropsida.

Unit-III:

GYMNOSPERMS: General characteristic feature of Gymnosperms, Classification of Gymnosperms and their distribution in India. General account of Cycadales, Coniferales, Ephedrales, and Gnetales.

Unit- IV:

PALEOBOTANY: Geological time scale, origin and geological evidences; evolutionary time scale (eras, periods and epoch). Types of fossils, processes of fossilization, role of fossils in evolution. Brief account of fossil Pteridophytes and Gymnosperms. Cycadeoidales, Pentoxylales, Medullosales and Glossopteriodales.

Select text books for reading:

1.Bhatnagar, S. P. and Moitra, A. (1996). Gymnosperms. New Age International, New Delhi.

2.Parihar, N. S. (1991). Bryophyta. Central Book Depot, Allahabad.

3Parihar, N. S. (1991). Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad. Chamberlin, C. J. (1935). Gymnosperms: Structure and Evolution. Dover Publications, New York Amold Scott

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PAPER: BOT103
BIOCHEMISTRY

100 marks (80+20)

4 CH

Unit-I:
Structure of atoms, molecules and chemical bonds. Composition, structure and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins).

Unit- II:
Conformation of nucleic acids (helix (A, B, Z), t-RNA, micro-RNA).Stability of proteins and nucleic acids. Metabolism of carbohydrates, lipids, amino acids nucleotides and vitamins.

Unit-III:
Bioenergetics, glycolysis, oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers. Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isozymes, Conformation of proteins (Ramachandran plot, secondary structure, domains, motif and folds).

Unit- IV:
Stabilizing interactions (Vander Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc.). Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties).

SUGGESTED READINGS:

Lehninger Principles of Biochemistry

Harper's Illustrated Biochemistry

Biochemistry by U.Satyanar

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PAPER: BOT 104

ANALYTICAL TECHNIQUES

100 marks (80+20)

Unit-I: 4 CH

Microscopic techniques: Visualization of cells and sub cellular components by light microscopy, resolving powers of different microscopes, microscopy of living cells, scanning and transmission microscopes, different fixation and staining techniques for EM, freeze-etch and freeze-fracture methods for EM, image processing methods in microscopy.

Unit- II:

Radiolabeling techniques: Detection and measurement of different types of radioisotopes normally used in biology, incorporation of radioisotopes in biological tissues and cells, molecular imaging of radioactive material, safety guidelines.

Unit-III:

Molecular analysis using UV/visible, fluorescence, circular dichroism, NMR and ESR spectroscopy Molecular structure determination using X-ray diffraction and NMR, Molecular analysis using light scattering, different types of mass spectrometry and surface plasma resonance methods.

Unit- IV:

Chromatography: Principle, Paper Chromatography, Ion exchange chromatography, Thin layer chromatography, gas chromatography, Electrophoresis technique, Autoradiography. Centrifugation: general principles, types of centrifuges, differential and density gradient centrifugation.

SUGGESTED READING (PAPER-104)

1. Instrumental Analysis for Science & Technology. W. Ferren, Agro Botanical Publication.
2. Biophysical Chemistry-Upadhyay&Nath.
3. Useful techniques for plant scientists by Dhopte.
4. Methods of soil physics by S.K. Jalota, R. Khera& B.S. Ghuman.
5. An Introduction to plant Taxonomy- C. Jeffrey
6. An Introduction of Systematic Botany & Ecology- J.N. Mishra
7. Ecology & Environment-P.D. Sharma, Rastogi Pub.
8. Plant Ecology- W.D. Bellings.
9. Fundamentals of Ecology - Wever& Clements.
10. Fundamental of Ecology-E.P. Odum.

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PAPER: BOT105

100marks PRACTICAL

4CH

DETAILED SYLLABUS SEMESTER-I

HOURS: 06 (PRACTICAL-IV)

Marks: 100

RACTICAL RELATED TO THEORY PAPERS)

Collection, Identification and Preservation of common infected plants of the locality

Symptomology study of diseased specimens.

Collection of algae from various habitat of locality, either separation, preparation temporary and permanent mounts and identification.

Microbiological Method: Measurement of length, breadth and diameter of algal/fungal cells and spores using ocular and stage micrometer.

Preparation and sterilization of media for the culture of Bacteria and Fungi.

Gram staining of Bacteria.

Identification of fungal cultures- Rhizopus, Mucor, Aspergillus, Pencillium, Fusarium.

Temporary and permanent preparation of slides of important genera belonging to allimportant classes of fungi.

Study of morphology, anatomy and reproductive structures of representative members of Bryophytes, Pteridophytes and Gymnosperm.

. Study of Mitosis and Meiosis by squashing technique. Drawing the chromosomes and different stages of Mitosis and Meiosis by using camera Lucida.

. Biometry

. Viva-Voce

actical record duly certified by the concerned teacher.

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SEMESTER II

PAPER: BOT 201

SYSTEMATICS OF ANGIOSPERM

100 marks (80+20)

4 CH

Unit I: Taxonomic Structure:
Taxonomic hierarchy; Concept of species, genus and family, Plant Nomenclature: Salient features of International Code of Nomenclature (ICN) for Algae, Fungi and Plants: priority, effective and valid publications and author citation. Type concept, Taxonomic Tools: Field and Herbarium techniques; Floras and Botanic Gardens, Computer and Taxonomy.

Unit II: Systems of Angiosperm classification
Major contributions of Theophrastus, Bauhin, Tournefort, Linnaeus, Adanson, de Candolle, Bessey, Hutchinson, Takhtajan and Cronquist; Classification systems of Bentham and Hooker (upto series) and Engler and Prantl (upto series). Hutchinson; Brief reference of Angiosperm Phylogeny Group (APG III) classification.

UnitIII Range of floral structures and comparative study of important orders.
Dicots: Ranales, Umbelliferae, Rosales, Asterales. Monocots: Glumiflorae, Scitamineae, Microspermae. Brief account of flora of Odisha.

UnitIV: Numerical taxonomy and Taxonomic evidences
Angiospermic cladistic, Variations, OTUs, Phenograms, Cladograms, Terms and concepts(Premitive and advanced, Homology and Analogy, Parallelism and convergence, monophyly, paraphyly, polyphyly and cladodes). Evidences: Anatomy, Palynology, Cytology, Phytochemistry, Evolution of Angiosperm (Phylogenetic tree).

SUGGESTED READINGS:

1. 1. Principles of Angiosperms Taxonomy by Davis, P. H. and Heywood, V. H., Robert E. Kreiger, New york.
2. Current Concepts in Plant Taxonomy by Heywood, V. H. and Moore, D. M., Academic press, London.
3. Principles and Methods Plant Biosystematics by Solbrig, O. T., MacMillan, London.
4. Plant taxonomy and Biosystematics by Stace, C. A.,Edward Arnold, London.
5. Diversity and Classification of Flowering Plants by Takhtajan, A. L. Columbia University Press,
6. Contemporary Plant Systematics by Woodland, D. W. Prentice-Hall, New Jersey, USA

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PAPER: BOT202

100 marks (80+20)

PLANT PHYSIOLOGY AND METABOLISM

Unit-I: 4 CH

Water relation: Properties of water, Types of solutions, Water potential – uptake, transport and translocation of water, ions, solutes and macromolecules from soil, through cells, across membranes, through xylem and phloem; transpiration; mechanisms of loading and unloading of photoassimilates.

Unit- II:

Photosynthesis - Light harvesting complexes; mechanisms of electron transport; photoprotective mechanisms; CO_2 fixation-C_3, C_4 and CAM pathways. Respiration and photorespiration – Citric acid cycle; plant mitochondrial electron transport and ATP synthesis; alternate oxidase; photorespiratory pathway.
Sensory photobiology - Structure, function and mechanisms of action of phytochromes, cryptochromes and phototropins; stomatal movement; photoperiodism and biological clocks.

Unit-III:

Nitrogen metabolism - Nitrate and ammonium assimilation; amino acid biosynthesis.
Plant hormones – Biosynthesis, storage, breakdown and transport; physiological effects and mechanisms of action.
ATP Synthesis- Mechanism of ATP synthesis, substrate level phosphorylation and oxidative phosphorylation, Chemiosmotic Mechanism (ETC), ATP synthesis, Boyers conformational change model, role of uncouplers.

Unit- IV:

Phytohormones- Discovery, chemical nature, transport and physiological role of Auxin, Gibberelins, Cytokinins, ABA, Ethylene, Brassinosteroids, Jasmonic Acids.
Secondary metabolites - Biosynthesis of terpenes, phenols and nitrogenous compounds and their roles.
Stress physiology – Responses of plants to biotic (pathogen and insects) and abiotic (water, temperature and salt) stresses.

JGGESTED READINGS:

Plant Physiology by Taiz and Zieger

Plant Physiology by Frank B. Salisbury, Cleon W. Ross

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Govt. Women's College, SBP

PAPER: BOT203

100 marks(80+20)

CELL AND MOLECULAR BIOLOGY

Unit-I: 4 CH

Membrane structure and function (Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, membrane pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes).
Structural organization and function of intracellular organelles (Cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure & function of cytoskeleton and its role in motility).

Unit- II:

Organization of genes and chromosomes (Operon, unique and repetitive DNA, interrupted genes, gene families, structure of chromatin and chromosomes, heterochromatin, euchromatin, transposons). Cell division and cell cycle (Mitosis and meiosis, their regulation, steps in cell cycle, regulation and control of cell cycle).
Microbial Physiology (Growth yield and characteristics, strategies of cell division, stress response)

Unit-III:

DNA replication, repair and recombination (Unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication, extrachromosomal replicons, DNA damage and repair mechanisms, homologous and site-specific recombination).
RNA synthesis and processing (transcription factors and machinery, formation of initiation complex, transcription activator and repressor, RNA polymerases, capping, elongation, and termination, RNA processing, RNA editing, splicing, and polyadenylation, structure and function of different types of RNA, RNA transport).

Unit- IV:

Protein synthesis and processing (Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, tRNA-identity, aminoacyl tRNAsynthetase, and translational proof-reading, translational inhibitors, Post- translational modification of proteins).
Control of gene expression at transcription and translation level (regulating the expression of phages, viruses, prokaryotic and eukaryotic genes, role of chromatin in gene expression and gene silencing).

SUGGESTED READING (PAPER-103)

1. Lewin. B.2000, Genes VII, Oxford Univ Press, New York.
2. Alberts B. Bray D, Lewis J. Raff M. Roberts K. Watson J.D. 1999 Molecular Biology of the cell.
3. Wolfe S.L., 1993, Molecular and Cellular Biology, Wadsworth Pub. Co. California, USA. Cucharaw BB Gruissem 4. W. Jones R.L. 2000 Biochemistry and Molecular Biology of Plant, American Society of Plant Physiologists.
4.Kleinsmith L...J. and Kish VM 1995, Principles of cell and Molecular Biology, harp and Collins College Pub. New York, USA
5.Lodish H. Berk A. Zipursky S.L. Matsudaira P. Baltimoru D. and Darnell J.2000,
6. Molecular Biology, W.H. Freeman & Co.
7.Alberts B. Bray D. Lewis J. Raff M. Roberts K. & Watson J.D. 1989 Molecular Biology of Cell,

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Garland Pub. Inc. New York.
8. Khush G.S. 1973 Cutogenetics of Aneuploids, Academmic Press New York.
9. Karp G. 1999, Cells and Molecular Biology, Concepts and experiments, Joh Wily & Sons Inc. USA.
10. Lewin B.2000 Genus VII, Oxford University Press New York, USA.
11. Russel P.J. 1998 Genetics, The Benjamin Cummings Pub. Co. USA.
12. Snustad DP and Simmons M.J. 2000 Principles of Genetics, John Wily and Sons Inc. USA.

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PAPER: BOT204

ECOLOGY AND BIOSTATISTICS

100 marks (80+20)

4 CH

Unit-I:

The Environment: Physical environment; biotic environment; biotic and abiotic interactions.Habitat and Niche: Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement.
Population Ecology: Characteristics of a population; population growth curves;population regulation; life history strategies (*r* and *K* selection); concept of metapopulation – demes and dispersal, interdemic extinctions, age structured populations.

Unit- II:
Species Interactions: Types of interactions, interspecific competition, herbivory, carnivory, pollination, symbiosis. Community Ecology: Nature of communities; community structure and attributes; levels of species diversity and its measurement; edges and ecotones. Ecological Succession: Types; mechanisms; changes involved in succession; concept of climax.
Ecosystem Ecology: Ecosystem structure; ecosystem function; energy flow and mineral cycling (Carbon,N,P); primary production and decomposition; structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine, estuarine).

Unit-III:
Biogeography: Major terrestrial biomes; theory of island biogeography; biogeographical zones of India.
Applied Ecology: Environmental pollution; global environmental change; biodiversity: status, monitoring and documentation; major drivers of biodiversity change; biodiversity management approaches. Conservation Biology: Principles of conservation, major approaches to management, Indian case studies on conservation/management strategy (Project Tiger, Biosphere reserves).

Unit- IV:

Biostatistics: Statistics, data, population, samples, variables, parameters, Representation of Data: Tabular, Graphical; Measures of frequency and central tendency: Arithmetic mean, mode, median, Measures of dispersion: Range, mean deviation, variance, standard deviation; Chi-square test for goodness of fit. Test of significance: comparison of large, small and paired samples (t-Test) and Correlation.

SUGGESTED READINGS:

1 Fundamentals of Ecology E.P. Odum

2 Ecology by M.C. Dash

3 Ecology by Sadabha

4 Biostatistics by Mishra and Mishra

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PAPER: BOT205

100marks **PRACTICAL** **4CH**

Description and Identification of Angiosperms family, genus and species level flora.

Herbarium techniques.

Microscopic study of ovules.

Determination of rate of photosynthesis

Preparation of Buffers.

Quantitave estimation of protein (Lowry methods/Bradford Method), Sugar (Anthrone Methodes), Lipids (B
yer Metghod).
Quantitative estimation of Amino acids (Ninhydrin methods)
Estimation of Pigments (Chlorophylls and carotenoids) from plant and algal materials.

solation of plant DNA and quantification of extracted DNA by spectrophotometric methods.

Soil Nitrogen estimation.
Soil Carbon estimation.
Measurement of Central tendency
Measurement of Dispersion
Student t-Test
Chi-Square Test

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Govt. Women's College, SBP

SEMESTER III

PAPER: BOT 301

PLANT EMBRYOLOGY AND ANATOMY

100 marks (80+20) 4 CH

-I:

and female gametophyte: Structure of anthers, microsporogenesis, role of tapetum, pollen development and gene ession, male sterility, sperm dimorphism and hybrid seed production, pollen germination, pollen tube growth and guidance, n storage, pollen allergy, pollen embryos. Female gametophyte: Ovule development, megasporogenesis; organization of the yo sac, structure of the embryo sac cell

- II:

ination, Pollen-pistil interaction and fertilization: Floral characteristics, pollination mechanisms and vectors, breeding m, commercial considerations, structure of the pistil, pollen stigma interactions, sporophytic and gametophytic self-mpatibility (cytological, biochemical and molecular aspects), double fertilization, in vitro fertilization.

-III:

l development and fruit ripening: Endosperm development during early, maturation and desiccation stages, embryogenesis, -structure; cell lineages during late embryo development; storage proteins of endosperm and embryo; polyembryony, nuxis; embryo culture, dynamics of fruit growth and ripening; Latent life-dormancy; Importance and types of dormancy, seed nancy, overcoming seed dormancy, bud dormancy.

- IV:

t Anatomy: Tissue and tissue system; Meristematic tissue, distribution of mechanical tissues, apical meristem, Anomalous ndary growth (adaptive and non-adaptive), Root-shoot transition, shoot-root development, leaf development and phyllotaxy, ition to flowering.

GGESTED READINGS:

1. Bewley, J. D. and Black, M. (1994). Seed: physiology of Development and Germination.
2. Plenum, New York.
3. Bhojwani, S. S. and Bhatnagar, S. P. (2008). The Embryology of Angiosperms. Vikas Publishing House, New Delhi,
4. Raghavan, V. (1997). Molecular Embryology of Flowering Plant. Cambridge University Press, Cambridge. Raghavan, V. (1999). Developmental Biology of Flowering Plants. Springer-Verlag, New York

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PAPER: BOT302

GENETICS, PLANT BREEDING AND EVOLUTION

100 marks(80+20) **4 CH**

it-I:

netics: Mendelism and deviation of Mendelian ratios, epistasis, linkage and crossing over, sex-linked inheritance, three point cross and chromosome mapping, Extra chromosomal inheritance.

togenetics: Structural Chromosomal aberrationc duplication, deficiency, inversion and translocations heterozygotes; Numerical romosome aberrations aneuploids: trisomics and monosomics; cuploids: autopolyploids, allopolyploids, role polyploidy in eciation with reference to Triticum and Brassica.

nit- II:

rigin and history of crop plants: Plant domestication morphological, agronomic and genetic features accompanying omestication of plants, Genetic erosion. Biological diversity and genetic variation: Kinds and patterns of variation, ariation and variability, genetics, utilization and analysis of genetic variation; qualitative and quantitative traits and eir genetics, polygenic inheritance, inbreeding depression, heterosis, recent development in quantitative genetics..

nit-III:

enetic system and breeding methods: Reproduction and breeding systems in plants. Recombination, genetic control d manipulation of breeding systems including male sterility and apomixis. Selection and breeding strategies for self-llinated, crosspollinated, breeding for crop quality, biotic and abiotic stresses, gene pyramiding for multi-trait corporation.

nit- IV:

nergence of evolutionary thoughts Lamarek; Darwin–concepts of variation, adaptation, struggle, fitness and natural selection; endelism; Spontaneity of mutations; The evolutionary synthesis. B. Origin of cells and unicellular evolution: Origin of basic ological molecules; Abiotic synthesis of organic monomers and polymers; Concept of Oparin and Haldane; Experiement of iller (1953); The first cell; Evolution of prokaryotes; Origin of eukaryotic cells; Evolution of unicellular eukaryotes; Anaerobic etabolism, photosynthesis and aerobic metabolism. C. Paleontology and Evolutionary History: The evolutionary time scale; Eras, eriods and epoch; Major events in the evolutionary time scale; Origins of unicellular and multi cellular organisms; Major groups f plants

UGGESTED READINGS:

win, B. (2004). Gene VIII. Person-Prentice Hall, London.

rce, B. A. (2006). Genetics: A Conceptual Approach. W. H. Freeman, New York.

rdner, Simmons & Snustad: Principles of Genetics, Jhon Willey & Sons Inc.

nt breeding by B.D. Singh

nt physiology by Salisbury and Ross

nt physiology by Teiz and Zeiger.

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PAPER: BOT 303

PLANT PATHOLOGY

100 marks (80+20)

4 CH

t-I:

nt pathology

siological, Biochemical, Genetic aspects of symbionts Host- Pathogen relationships; Disease cycle and ironmental relation; General symptoms; Geographical distribution of diseases; etiology; symptomology; prevention l control of plant diseases and role of quarantine. Bacterial diseases - Citrus canker and angular leaf spot disease of tton. Viral diseases-Tobacco Mosaic viruses, vein clearing. Fungal diseases - Early blight of potato, Black stem rust wheat, white rust of crucifers.

nit- II:

hytopathology: Plant disease symptoms, modes of infection and dissemination; altered metabolism of plants under iotic and abiotic stresses; host-parasite relationship, molecular mechanism of pathogenesis, recognition phenomenon, enetration and invasion. Primary disease determinant; enzymes and toxins in relation to plant diseases; mechanism of sistance; phytoalexins, PR proteins, antiviral proteins, SAR, HR and active oxygen radicals.

nit-III:

istorical introduction to Mycology, definition of different terms, basic concepts. Importance of Mycology in griculture, relation of fungi to human affairs, history of mycology. Morphology of reproductive structures and nidiogenous cells, Spore types, Saccardo's spore grid, groups and its taxonomic bearing, Concepts of nomenclature d classification, fungal biodiversity, reproduction in fungi. The comparative morphology, ultrastructure, characters of fferent groups of fungi up to generic level: (a) Myxomycota and (b) Eumycota- i) Mastigomycotina ii) ygomycotina, iii) Ascomycotina, iv) Basidiomycotina, v) Deuteromycotina. Lichens types and importance, fungal netics and variability in fungi.

nit- IV:

istory of plant viruses, composition and structure of viruses. Symptomatology of important plant viral diseases, nsmission, chemical and physical properties, host virus interaction, virus vector relationship. Virus nomenclature and assification. Structure of plant virus, genome organization, replication and movement of viruses. Isolation and rification, estimation of virus titre and purity, electron microscopy, protein and nucleic acid based diagnostics. ycoviruses, phytoplasma arbo and baculoviruses, satellite viruses, satellite RNAs, phages, viroids, prions. Origin and olution, mechanism of resistance, genetic engineering, ecology, and management of plant viruses.

HOD
Deptt. Of Botany
Govt. Women's College, SBP

PAPER: BOT304

NATURAL RESOURCE, CONSERVATION AND UTILIZATION

100 marks (80+20)

4 CH

nit-I:

atural resources and management: Conservation of natural resources, Non-renewable energy resources, Alternative sources of nergy, new concepts for alternative energy. Renewable energy resources: soil resources, Soil conservation and management. Vater resources and conservation: rain water harvesting, water shed management. Forest as a renewable resource, deforestation, fforestation, conservation,social forestry, wild-life conservation.

Unit- II:

World Centres of Primary Diversity of Domesticated Plants: Basic concepts, origin of agriculture and plant introduction. Origin, evolution, botany, cultivation and uses of (1) Food crops, (ii) fibre crops, (iii) medicinal and aromatic plants, and (iv) vegetable a oil-yielding crops with special reference to local plants. Plants, plant parts and plant products used in traditional medicines, important timber-yielding plants, Important poisonous plants of India. Unit III:

Unit-III:

n situ conservation: International efforts and Indian initiatives; protected areas in India Sanctuaries, national parks, biosphere eserves, wetlands and mangroves for conservation of wild biodiversity. Ex situ conservation: Principles and practices; botanical ardens, field gene banks, seed banks,

Jnit IV:

ryobanks, general account of the activities of Botanical Survey of India (BSI), National Bureau of Plant Genetic Resources NBPGR). Principles of conservation; extinction; environmental status of plants based on IUCN (Now World Conservation nion). Salient features of Biodiversity Act and rules.

elect text books for reading:

onway, G. and Barbier, E. (1994). Plants, Genes and Agriculture. Jones and Bartlett, Boston, USA.

eywood, V. H. and Wyse Jackson, P. S. (1991). Tropical Botanical Gardens, Their role in Conservation and Development. cademic press, San Diego, USA.

othari, A. (1997). Understanding Biodiversity: Life sustainability and Equity. Orient Longman, New york. Negi, S. S. (1993). iodiversity and its Conservation in India, Indus Publishing Company, New Delhi.

mmonds, N. W. (1979), Evolution of Crop Plants. Longman, New York.

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Govt. Women's College, SBP

PRACTICAL

[illegible]

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SEMESTER IV

PAPER: BOT 401

ADVANCE PLANT BIOTECHNOLOGY

100 marks (80+20) **4 CH**

Unit-I:

Tissue culture techniques: Totipotency, Media preparation, types of media(liquid and solid), Hybrid Production And Germplasm Conservation Selection of heterokaryotic fusion products, analysis of hybrids, somatic hybrids and cybrids crop improvement, artificial seeds, cryopreservation, , Vector-mediated Gene Transfer to plants Molecular basis of gall and hairy root diseases, features of Ti plasmids, vectors based on PT & PR binary and co-integrate vectors, optimized protocols for Agrobacterium-mediated m transformation, transgenic Plant viruses as vectors. physical methods (particle bombardment microprojectile/biolistics, electroporation, microinjection), chemical methods (PEG-mediated).

Unit- II:

Processing of The Recombinant Proteins Purification and refolding characterization, stabilization. Analysis of proteins: SDS-PAGE, 2-D Gel electrophoresis, methods used for generation of homoplasmic transplastomic plants, vectors for chloroplast tranformation, strategies for optimizing foreign gene expression in chloroplast, transplastemics without antibiotic resistant me, applications of chloroplast transformation Metabolic engineering: Molecular farming of carbohydrates, lipids and proteins

Unit-III:

Antisense RNA Technology Regulatory RNA (micro RNA), Antisense RNA, construction of antisense vectors, analysis of antisense clones, applications of antisense technology. Gene silencing causes (DNA methylation, homology-dependent suppression by antisense gene), strategies for avoiding gene silencing, methods of inducing gene silencing and its application. Diagnostics in agricultures and molecular breeding: ELISA. Opine assay, enzyme activity assay (GUS, NPT), transient and stable expression, transgene stability and silencing, production of marker free transgenic plants: co-transformation, site specific recombination, intra-chromosomal recombination. Biosafety regulation.

Unit- IV:

Detection of Transgene and Products, commercialization, Gene tagging: Transposable genetic elements in bacteria, IS elements, composite transposon, Class I & II transposable elements in eukaryotes, isolation of genes by transposon gene tagging and T-DNA tagging DNA Sequencing: Sanger's technique, Maxam & Gilbert technique and automated sequencing. Advantages of transgenics.

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Deptt. Of Botany
Govt. Women's College, SBP

PAPER: BOT402

ENVIRONMENTAL BIOTECHNOLOGY

marks (80+20) **4 CH**

it I: Basic Environmental biotechnology: Scopes and issues, basic environmental problems-pollution,land degradation, forestation, biodiversity loss and eutrophication, biotechnology for saferenvironment, biotechnology for resource management d biomass production, biotechnology for generation of biogas and bio fuels.

nit II: Bioaccumulation: Concept and measurement, food chain and lipophilicity approach, quantitativestructure activity elationship, kinetics of uptake and retention, factors affecting bioaccumulation. Bioaccumulation of metals: metal accumulation y flora and fauna: biosorption, phytofiltration, phytochelation and phytoextraction.

Unit III: Bioremediation: Types and application, Biodegradation of pesticides and hazardous wastes, Degradation of oil spills. Biosorption. use of bacteria in biosorption, use of fungi in biosorption, use of algae in biosorption, biomineralisation and bioleaching. Microorganism involved in bioleaching of ores, mechanism of bioleaching.

nit IV: Biological Wastewater treatment and disposal: Activated sludge process, biological filters, rotatingbiological ontractors.Anaerobic Biological treatment (contact digester, packed Bed reactor Baffled digester, Biological reactor). Land eclamation and crop productivity.

UGGESTED READINGS

Mahapatra, P.K. (2006) Textbook of Environmental Biotechnology, IK International Publishing House.
Varun Mehta (2008).Environmental Biotechnology , 1st edition, Campus Book s International, New Delhi
M. Jay (2007). Environmental Microbiology and Biotechnology. 1st edition. Swastik Publishers & Distributors, New Delhi
P. Vashisth (2005). Environmental Biotechnology. 1st Edition, Dominant Publishers and Distributors, New Delhi
D.K. Markandey and NeelimaRajvaidya (2004). Environmental Biotechnology. Ist Edition. APH Publishing Corporation, New elhi.
InduSekhar Thakur (2006). Environmental Biotechnology: Basic concepts and applications. IK International Publishing House.
B. E. Rittmann, P. L. McCarty, (2001) Environmental Biotechnology: Principles and Applications, McGraw-Hill.
Seviour R, and P.H. Nielsen. (2010.) Microbial Ecology of Activated Sludge, IWA Publishing,

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Deptt. Of Botany
Govt. Women's College, SBP

PAPER: BOT403 E-A

PHYTOMEDICINE

52

0 marks (80+20)

4 CH

nit-I:

portance of medicinal plants: Relevance of herbal medicine as primary health care package; sources of information on dicinal plants, Organization of information in database (national and international); Causes for the decline and the current scenario in Indigenous systems of medicine; a comparative evaluation of accessibility and benefits of different systems

Unit- II:

Marine Drugs: Introduction, Classification antimicrobial, anti-inflammatory, antispasmodic, antiparasitic, anticancer, cardiovascular, insecticide, anticoagulants, marine toxins, Algae as potential source of therapeutic compunds

Unit-III

Potentials of medicinal plants: WHO and Indian Scenario; herbal medicine - a natural resource; commercial and medicinal uses of medicinal plants in India. Study of few commercial /raw drugs/ medicinal plants - Usnea; Drynaria; Pinus; Vinca rosea; Rauwolfia serpentina, Withania somnifera; Coleus forskohlii; Emblica officinalis; Saraca asoca; Aloe vera; Glycyrrhiza glabra; Commiphora mukul, Boswelia serrata

Unit-IV

Poisonous plants: Classification; chemical constituents, symptoms, treatment and systematic description of some poisonous plants - Papaver somnifera, Calotropis gigantea, Gloriosa superba, Digitalis purpurea, Datura metel, Strychnos max-vomica

Plant Allergens: Types and classification; description, symptoms, chemical constituents and treatment of the following allergic plants - Parthenium hysterophorus, Urtica sp. Acacia sp. Eucalyptus globulus, Arachis hypogaea and Solanum

Total

Referred Text books:

1. Phytomedicine edited by Rouf Ahmad Bhat, Khalid Hakeem, Moonisa Aslam Dervash
2. Phytomedicine edited by Parimelazhagan Thangaraj

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Deptt. Of Botany
Govt. Women's College, SBP

PAPER: BOT403E-B

100 marks (80+20)

MOLECULAR STRESS BIOLOGY

nit-I: 4 CH

fining stress Acclimation and adaptation. Brief introduction to diverse stressors in plant, animals and human
vironmental factors Abiotic stress (Water; Salinity, High light, Temperature); Biotics stress (Hypersensitive reaction;
thogenesis– related (PR) proteins; Systemic acquired resistance; Mediation of insect and disease resistance by jasmonates) in
ants and animals. Lifestyle and environment induced functional (hormonal, cardiovascular and hepato-renal) changes.
osturerelated stress- system design, system optimisation.

Unit- II:

Stress sensing mechanisms Role of nitric oxide. Calcium modulation, Phospholipid signaling, growth factors, salicylic acid
ignalling, arachidonate. Developmental and physiological mechanisms that protect plants, animals and human against
environmental stress Morphological, biochemical and genetic adaptation in plants in osmotic stress; Xenobiotics and
iotransformation.
edox imbalance, Reactive oxygen species, Production and scavenging mechanisms

nit III:-Stress Physiology

uantitative estimation of peroxidase activity in the seedlings in the absence and presence of salt stress.
uperoxide activity in seedlings in the absence and presence of salt stress, Quantitative estimation of peroxidase and superoxide
smutase activity, catalase, glutathione reductase. Estimation of superoxide anions, Salt stress assay in plants, Assessment of
fferent nutritional and physiological stress parameters in individuals involved in different workplace stressors.
echanism of biotic and abiotic stress tolerance, IR and SAR, water deficit and drought resistance, salinity stress, metal stress,
eezing and heat stress, oxidative stress.

nit IV: Signal Transduction

rmones and their receptors, cell surface receptors, signaling through G-protein coupled receptors, signal transduction pathways
cond messengers, phospholipid signaling, role of cyclic nucleotides, calcium-calmodulin cascade, diversity in protein kinases
d phosphatases. specific signaling mechanisms (two component sensory regulatory system in bacteria and plants. sucrose-
nsing mechanism).

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Govt. Women's College, SBP

PAPER: BOT404

ENVIRONMENTAL AND WASTE MANAGEMENT

100 marks (80+20) **4 CH**

t-I: Introduction of Environmental Biotechnology: Scope and importance • Global impact of biotechnology Healthcare, iculture • Environment, Biotechnology in India • Need for future development • Ban on genetic food • Gene bank and Plant servation.

mass : Biomass as an energy source • Composition of biomass • Terrestrial biomass, Aquatic biomass • Saline water hyacinth • ste as a renewable source of energy, • enzymatic digestion.

nit- II: Biomass energy: Petroleum plants • Hydrocarbon from higher plants • Alcohol the liquid fuel • Biogas

ioremediation

n situ bioremediation • Intrinsic bioremediation • Ex-situ bio remediation • Bioremediation of hydrocarbons – use of mixture of acteria • Use of genetically engineered bacterial strains

nit-III:

purces, generation, classfication & composition of solid wastes. Solid waste management methods - Sanitary land filling, ecycling. Composting. Vermi composting, Incineration, energy recovery from organic waste.
olid Waste Management Plan, Waste minimization technologies, Hazardous Waste Management, Sources & Classification, hysicochemical properties, Hazardous Waste Control & Treatment.

nit- IV:

ospital Waste Management, Hazardous Waste Management & Handling rules, 1989 & 2000 (amendments)

isaster Management, Fly ash generation & utilization, Primary, secondary & tertiary & advance treatment of various fluents.

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Deptt. Of Botany
Govt. Women's College, SBP

PAPER-BOT-405

PROJECT, SEMINAR PRESENTATION, FIELD STUDY, SCIENTIFIC VISIT

100 marks (80+20) **4 CH**

Objectives: The objectivesofthiscourscaretodevelopresearchaptitude,scientifictemper anderiticalanalysisamongstudents.

Learning Outcome: Students are expectedtogainthebasicskillinprojecthandlingandwritingoftheirprojectreport, which will behelpful forthemto bean independentscientist.

Plan and Execution: Projectworkof IVthsemesterwill beassignedtothestudentsatthebeginningof IIIrdsemester and will be completed in the IVth semester. The students will plan and carryout projects with self-involvement through understanding and learning of different research tool and techniques. During theirresearchtenure the studentslearnthe skillof writingtheses,articlesandprojectfor their future benefits.

ProjectReport/Dissertation: Attheendoftheproject, theseshavebeenwrittengiving fulldetailsabouttheir project. Project report should include introduction, background of the problem, Review of literature,objectives,methodology,results, discussionandreferences.Evaluationoftheprojectreportandvivavocewillbeopendefensetypethroughpowerpointpr esentationandevaluatedbybothexternalandinternal examiners.

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Deptt. Of Botany
Govt. Women's College, SBP

DistributionofMark/work:

SEMESTERWISEWORKANDDISTRIBUTIONOFMARKSIN%FORPROJECT				
IIIrdSEMESTER(20%)EVALUATIONOFINTERIMREPORTOFTHEPROJECTWORK				
Background of theproblem(5%) (5marks)	Review of Literatre (5%)(5mark)	Objectives(5%) (5marks)	Methodology(5%) (5marks)	Total(20%) 20marks
IVthSEMESTER(80%)EVALUATIONOFFINALREPORTOFTHEPROJECTWORK				
Projectwork(50%)–50marks		Viva(30%)= 30marks		Total(80%)-80marks
GRANDTOTAL		**4CH**		**100 MARKS**

HOD
Deptt. Of Botany
Govt. Women's College, SBP

M.Sc–BOTANY

DISTRIBUTION OF MARKS IN PERCENTAGE FOR THEORY PAPERS

(Reference:LetterNo6220/AcdIdated01.10.2022of SambalpurUniversity)

EndTerm	Midterm	Total
80% -80marks	20% -20 marks	100%-100marks

MIDTERMEXAMINATION

In eachtheorypaperfollowingdistributionof marks formid semester examwillbefollowed.

Classtest (5%)	Classtest (5%)	Assignment (5%)	Casestudy (5%)	Total (20%)
5marks	5 marks	5marks	5marks	20marks

ENDTERMEXAMINATION

(Fourunitcourse)

Time:3h FullMark: 80

Q1.Twentyquestionsof1markeach(MCQ/fillintheblanks/True-False,Definitionetc)

1x20=20

2.ForUnit-I,Unit –II,Unit-IIIandUnit-IV

15x4=60E

achquestionwill beof15 marksand itshouldhavealternativeineachunit

(Suggestedpatternofdistributionof15marksare15;8+7;7.5+7.5;5+10; 2+3+10;5+5+5)

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Deptt. Of Botany
Govt. Women's College, SBP

M.Sc– BOTANY

SAMPLEQUESTIONPAPER

PRACTICAL

Time:6h Fullmark–100

Answerallquestions

Q1.Minor experiment(AnyOne)

20marks

a.---
b.---
c.----
d.---
e.Any other experiment suggested by the

examinerQ2. Majorexperiment (AnyOne) 30marks

a.---
b.---
c.---
d.---
e.Anyotherexperiment suggestedbythe

examinerQ3.Spotting(Any08in consultation with

externalexaminer)

(Museumspecimen/slides/models/visualaid/instrument

3.5x8=28marks

Q4.Practical Record. 05 marks

Q5.SeminarpresentationandReport 10
marksSeminar Presentation in class seminar -05
marksSeminarReport Preparation –05 marks

Q6. Vivavoce 07marks

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Deptt. Of Botany
Govt. Women's College, SBP

QUESTIONPATTERNANDDISTRIBUTIONOFMARKSIN THEORYPAPEROFFEREDBYOTHERDEPARTMENTS

(Reference:LetterNo6220/AcdIdated01.10.2022ofSambalpurUniversity)

TheoryPaperofferedby otherDepartment	
End Term	MidTerm
60%	40%

MIDTERMEXAMINATION

Classtest	Classtest	Assignment	Casestudy	Total
10%	10%	10%	10%	40%

ENDTERMEXAMINATION

Forendtermexaminationoftotalmarks60(Fourunit course)

Q1.Twelvequestionsof1markeach(MCQ/fillintheblanks/True-False,Definitionetc)

1x12=12

2. ForUnit-I,Unit –II,Unit-IIIandUnit-IV 12x4=48

Eachquestionwillbeof 12 marksanditshouldhavealternativeineachunit.Thedistribution ofmarks willbedecidedbythe paper setter.

(Suggestedpatternofdistribution of12marksare12; 8+4;6+6;2+3+7;4+4+4 etc.)

HOD
Deptt. Of Botany
Govt. Women's College, SBP

MOOCs COURSE(3CH)

(InIInd or IIIrd SEMESTER)

The students will take one MOOCs course according to his /her preference inconsultation with HOD and submit the documents in support of undertaking theMOOCscoursetotheDepartment.Thestudentswillpreferthecourserelatedtosubject concerned. The duration of course will be **12-16** week. The students arerequired to submit their course certificate after completion of course in theDepartment. For MOOCs course the pass percentage is as per the programmeguidelines.

NONCREDITCOURSE

1. YuvaSanskar-**IstSemester–**
   HODoftheconcernedDepartmentwilltakecareofthecourse
2. N.C.C/N.S.S/Sports/PerformingArts/Yoga(ofwhichonehastobeopted) **–IIndorIIIrdSemester**
   Thecourseinchargewillfloat thecourseatthe beginningofthesemester

PASSPERCENTAGE

1. For each paper pass percentage is 30% (G P 4). For clearing the semesterGradePoint Average(GPA) should be4.5(40%).
2. ForIDC,EnvironmentalstudiesandDisasterManagementandEntrepreneurship Development Programme the pass percentage is 30% (G P4).
3. For MOOCscourse thepasspercentageisaspertheProgramme guideline.

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Deptt. Of Botany
Govt. Women's College, SBP