Hindi Vidya Prachar Samiti's

Ramniranjan Jhunjhunwala College

of Arts, Science & Commerce

(Autonomous College)

Affiliated to

UNIVERSITY OF MUMBAI

Syllabus for the M.Sc.

Program: M.Sc. BOTANY

Program Code: RJSPGBOT

(CBCS 2020-2021)

M.Sc Botany Semester III

Outline of the Course: RJSPGBOT301 and RJSPGBOT302 are common papers for all specialisations

RJSPGBOT301: Techniques and Instrumentation.

RJSPGBOT302: Cell and Molecular Biology.

RJSPGBOT303 and RJSPGBOT304 are Optional Papers in any one of the following specialisations.

1. Plant Physiology and Biochemistry (PPB)

2. Molecular Biology, Cytogenetics and Biotechnology (MCB)

Theory – RJSPGBOT301	4 Credits
Theory – RJSPGBOT302	4 Credits
Theory – RJSPGBOTPPB303/ RJSPGBOTMCB303	4 Credits
Theory – RJSPGBOTPPB304/ RJSPGBOTMCB304	4 Credits
Practical's (based on all 4 courses) – RJSPGBOTP301, RJSPGBOTP302, RJSPGBOTPPBP303/ RJSPGBOTMCBP303, &RJSPGBOTPPBP304/ RJSPGBOTMCBP304	8 Credits

SEMESTER IV (Common Papers)

Course Code	UNIT	TOPIC HEADINGS	Credits	L / Week
RJSPGBOT301	Title of the Paper: TECHNIQUES AND INSTRUMENTATION			
	I	Cell signalling	4	1
	II	Nanotechnology		1
	III	Centrifugation and Tracer Technique		1
	IV	IPR		1
RJSPGBOT302	Title of the Paper: Molecular Biology			
	I	DNA replication and Transcription	4	1
	II	RNA processing and Translation		1
	III	Gene Regulation I and II		1
	IV	Gene Regulation III		1

RJSPGBOT P301	Techniques and instrumentation	2
RJSPGBOTP302	Molecular Biology	2

Specialization: Plant Physiology and Biochemistry

RJSPGBOTPPB303	Title of the Paper: Plant Biochemistry		4
	I	Enzyme and plant proteins	1
	II	Cytosolic Carbon & Mitochondrial Metabolism	1
	III	Lipid and nucleotide metabolism	1
	IV	Amino Acid and sulphate Metabolism	1
RJSPGBOTPPB304	Title of the Paper: Plant Physiology		4
	I	Stress physiology – abiotic and biotic	1
	II	Membrane transport	1
	III	Metabolism of secondary metabolites	1
	IV	Senescence and sensory photobiology	1

RJSPGBOTPPBP303	Plant biochemistry	2
RJSPGBOTPPBP304	Plant physiology	2

Specialization: Molecular Biology, Cytogenetics and Biotechnology (MCB)

RJSPGBOTMCB303	Title of the Paper: Plant Biotechnology			
	I	Plant tissue culture	4	1
	II	Industrial Biotechnology, Down processing and techniques		1
	III	Environmental Biotechnology		1
	IV	Food Biotechnology and Biotransformation		1
RJSPGBOTMCB304	Title of the Paper: Molecular Biology and Cytogenetics			
	I	Cytology and Cancer Biology	4	1
	II	Plant Breeding		1
	III	Immune system and genetic diseases		1
	IV	Molecular Plant Breeding and Plant Genetic Engineering		1

RJSPGBOTMCBP303	Plant Biotechnology	2
RJSPGBOTMCBP304	Molecular Biology and Cytogenetics	2

SEMESTER III (General Papers)

Course Code	Topic	Credits
RJSPGBOT301	TECHNIQUES AND INSTRUMENTATION	4
UNIT I: Cell signaling 1. Hormones and their receptors, cell surface receptor, intracellular receptor, signaling through G-protein coupled receptors, signal relay pathways-signal transduction pathways, second messengers, regulation of signaling pathways, bacterial and plant two-component systems, Modulation of plant genomes by natural PGRs- Auxins, GA, Cytokinins, Ethylene & ABA. Light signaling in plants, bacterial chemotaxis and quorum sensing. 2. Forms of signaling (paracrine, synaptic, autocrine, endocrine, cell to cell contact).		1
Unit II: Nanotechnology 1. Synthesis of nanoparticles using biological samples. 2. Characterization of nanoparticles (FTIR, SEM, TEM, STEM, Scanning Tunneling Microscope, Atomic Force Microscope, UV-Visible Spectrophotometer). 3. Application of nanomaterials in food, cosmetics, agriculture, environment management and medicine. 4. Risk of Nanomaterial to human health and Environment.		1
Unit III: Centrifugation and Tracer techniques 1. Basics principle of Sedimentation. 2. Types of rotors and Differential & density gradient centrifugation. 3. Preparative centrifugation & Applications; Analytical centrifugation & application. 4. Pattern and rate of radioactive decay, Units of radioactivity, Stable Isotopes 5. Principle, instrumentation & technique: Geiger-Muller counter, Liquid, scintillation counters & Autoradiography. 6. Applications of isotopes in biology: Tracer techniques & Autoradiography. 7. PCR and its applications.		1
Unit IV: IPR 1. Introduction to intellectual property right (IPR) 2. Concept and kinds. IPR in India and world 3. Patents Objectives, Rights, Patent Act 1970 and its amendments. 4. Information Technology Related Intellectual Property Rights; Computer Software and Intellectual Property		1

M.Sc.	Semester IV Theory
RJSPGBOT301 Paper I Techniques and instrumentation	**Course Outcome 3.1:** 1. Study of mechanism and types of cell signaling. 2. Detailed study and application of centrifugationand analysis of Differential & density gradient solution. 3. Study of tracer techniques with applications of isotopes in biology 4. Synthesis of nanoparticles using biological samples 5. Detailed study of all type of chromatography techniques and its applications. 6. Detailed study of IPR: Outcomes, process & scope. 7. Instrumentation techniques **Learning outcome:** ➢ Learning mechanism and types of cell signaling with its application ➢ Knowing the working and application of centrifugation ➢ Mechanism of all different types of chromatography techniques ➢ Understanding the application of nanoparticles ➢ Learning the tracer techniques & PCR with applications ➢ Understanding the application of IPR ➢ Development of application skill

Course Code	Topic	Credits
RJSPGBOT302	Molecular Biology	4
UNIT I: DNA Replication and Transcription ➢ Molecular details of DNA replication in prokaryotes and eukaryotes. ➢ Assembly of raw DNA into nucleosomes. ➢ DNA recombination, Holliday model for recombination. ➢ Transcription, RNA synthesis, classes of RNA and the genes that code for them. ➢ Transcription of protein coding genes, prokaryotes and eukaryotes, mRNA molecule. ➢ Transcription of other genes, ribosomal RNA, and ribosomes		1
Unit II: RNA Processing and Translation ➢ Capping, polyadenylation, splicing, introns and exons. ➢ snRNA, Types of snRNA, snRNA in spliceosome, significance of snRNA ➢ Non-coding RNAs, ribozyme, riboswitches, RNA localization. ➢ Protein structure, nature of genetic code, translation of genetic message. ➢ Post translational modifications, localization, chaperons.		1
Unit III: Gene Regulation I and II ➢ Regulations of gene expression in bacteria – TRP operon, ARA operon, Histidine operon. ➢ Regulation of gene expression in bacteriophage λ. ➢ Control of gene expression in eukaryotes, Transcriptional control, RNA processing control, mRNA translocation control, mRNA degradation control, protein degradation control.		1
Unit IV: Gene Regulation III ➢ Genetic regulation of development in *Drosophila*. ➢ Developmental stages in *Drosophila* – embryonic development, imaginal discs, homeotic genes.		1

M.Sc.	Semester III Theory
RJSPGBOT302 Paper II Molecular Biology	**Course Outcome 3.2:** 1. Detailed study of Molecular details of DNA replication and recombination in prokaryotes and eukaryotes. 2. Mechanism of gene expression in transcription, RNA synthesis, protein coding genes and RNA processing post transcription in prokaryotes and eukaryotes. 3. Translation and post translational modifications. 4. Detailed study of Regulations of gene expression in bacteria and bacteriophage λ. *5.* Genetic regulation of development stages in *Drosophila*. **Learning outcome:** ➢ Understanding concept of molecular biology in detail ➢ Learning the application of tools in molecular biology ➢ Understanding concept of Regulations of gene expressions ➢ Understanding concept of molecular biology in detail

RJSPGBOTP301	TECHNIQUES AND INSTRUMENTATION	2
➢ Purification of chloroplast using density gradient centrifugation ➢ Isolation of mitochondria ➢ Synthesis of nanoparticles. ➢ Characterization of nanoparticles by UV spectroscopy. ➢ Project based on IPR ➢ Separation of plant proteins using PAGE ➢ IPR assignment ➢ Filing a patent. ➢ Industrial visit and report submission.		

RJSPGBOTP302	Molecular Biology	2
➢ Aseptic techniques, safe handling of microorganisms. ➢ Establishing pure cultures, Streak Plate method (T-streak and pentagon method), Pour plate, Spread plate. ➢ Isolation of isolation and quantification of genomic DNA ➢ Isolation of plasmid DNA. ➢ Quantification of plasmid DNA. ➢ Agarose gel electrophoresis separation of plasmid DNA. ➢ Restriction enzyme digestion and separation of fragments. ➢ Southern blot transfer technique. ➢ Transformation of *E. coli* cell by plasmid DNA. ➢ β-galactosidase expression and assay		

Specialization: Plant Physiology and Biochemistry (PPB)

Course Code	Topic	CREDITS
RJSPGBOTPPB303	Plant Biochemistry	4
Unit I: Enzymes and Plant Proteins 1. Purification and Isolation 2. Biochemical regulation 3. Isoenzymes 4. Vitamins – structure and Coenzyme activity 5. Lectins and storage proteins in plants, transamination, oxidative deamination and Urea cycle.		1
Unit II: Cytosolic carbon and Mitochondrial metabolism. 1. Synthesis and breakdown of Sucrose and Starch, regulation of Glycolysis and Gluconeogenesis. 2. Catabolic role of the TCA cycle, Anabolic role of the TCA cycle intermediates 3. Anapleurotic CO_2 fixation, provision of acetyl CoA for biosynthesis, Regulation of TCA.		1
Unit III: Lipid and nucleotide metabolism 1. Biosynthesis and degradation of odd carbon chain FA, structural and storage lipids 2. Synthesis and Function of membrane, structural & storage lipids, Omega fatty acids, beta oxidation of odd and even carbon containing fatty acids. 3. Purine and Pyrimidine biosynthesis and regulation. 4. Recycling of Purine and Pyrimidine nucleotides by salvage pathways.		1
Unit IV: Amino acid and sulphate metabolism. 1. Biosynthesis of Amino Acids (Proline, Glycine, Asparagine, Tryptophan, Phenylalanine), Regulation of amino acid biosynthesis 2. Sulphate Overview, Uptake and transport and Reductive sulphate pathway		1

M.Sc. (PPB)	Semester III Theory
RJSPGBOTPPB303 Paper-III Plant Biochemistry	**Course Outcome 3.3:** 1. Study of Mechanism of all types of enzyme, catalyst, regulation and kinetics. 2. Study the role of lectins (plant proteins). 3. Detailed study of nucleotide metabolism and its synthesis. 4. Study of lipid metabolism synthesis and function of membrane, structural & storage lipids 5. Detailed study biosynthesis and regulation of amino acids 6. Study of the cytosolic carbon and mitochondrial metabolism **Learning outcome:** ➢ Understanding the regulation of all types of enzymes. ➢ Know the importance of plant lectins. ➢ Understanding the biosynthesis and regulation of nucleotide metabolism. ➢ Understanding the lipid and aminoacids synthesis and regulation. ➢ Learning the importance cytosolic carbon and mitochondrial metabolism.

Course Code	Topic	Credits
RJSPGBOTPPB304	Plant Physiology	4
Unit I: Stress Physiology – Abiotic stress and Abiotic stress 1. Drought - Morphological and cellular adaptations, mechanism of drought tolerance, role of Proline, Glycine betaines, Mannitol, Pinitol and Osmotin in stress resistance. 2. Salinity - Generic Pathway for Plant Response to stress effect of salt on metabolic processes, Mechanism of salt resistance- salt avoidance (exclusion, extrusion and dilution) and tolerance (Regulation of ion homeostasis by SOS pathway), Role of Glycine betaine and Proline in Salinity Stress, DEAD-Box Helicases in Salinity Stress Tolerance. 3. Freezing stress, Oxygen stress and Flooding 4. Oxidative stress and Heat stress		1
Unit II: Membrane transport 1. Overview and Organisation of transport at plant membrane 2. Pumps – Proton pump, H^+ ATPase and Ca^{+2} ATPase 3. Carriers and Ion Channels – K^+ and Ca^{+2} channels 4. Aquaporins		1
Unit III: Metabolism of secondary metabolites and Phytoremediation 1. General biosynthetic pathways in the formation of secondary metabolites. Biosynthesis and role of Phenols, Phenylpropanes, Coumarins, lignins, flavonoids, alkaloids, tannins, and terpenes 2. Types of Phytoremediation- Advantages & limitations, Remedial measures- Rhizosphere based & Plant based, Hyper accumulators. 3. Role of genetic engineering & various enzymes in phytoremediation.		1
Unit IV: Senescence and sensory photobiology 1. Pigment Metabolism, Protein metabolism and Oxidative metabolism during senescence. Programmed cell death (PCD) an overview. 2. Structure, function and mechanism of phytochromes, Cryptochromes and Phototropins, Phytochrome induced whole plant response, Molecular basis of flower organization: MADS box genes and their expression. Problems based on ABC model for flower organization.		1

M.Sc. (PPB)	Semester III Theory
RJSPGBOTPPB304 Paper-IV Plant Physiology	**Course outcome 3.4:** 1. Detailed study of concept of water potential, transport and translocation in plants. 2. Understanding the mechanism of adaptation of plants under stress conditions 3. Physiology of plants under stress 4. Detailed study of biosynthetic pathways and biosynthesis of secondary metabolites 5. Study of pigment, protein and oxidative metabolism during senescence. 6. Understanding the mechanism of sensory photobiology and molecular basis of flower organization. **Learning outcome:** ➢ Understanding the role of water, ions, solutes and macromolecules in transport and translocation in plants ➢ Understanding detailed concept of stress metabolites their importance and applications ➢ Understanding the role of secondary metabolites and its Commercial application ➢ Understanding the senescence regulation and Phytochrome for desired designed plants

RJSPGBOTPPBP303	**Plant Biochemistry**	**2**
➢ Separation of proteins by Ion exchange chromatography. ➢ Separation of amino acids by two-dimensional chromatography. ➢ Viscosity studies of proteins: standard BSA and varying concentrations of urea ➢ Estimation of Tryptophan. ➢ Estimation of polyphenols from suitable plant material ➢ Extraction & separation of Glucosinolates from Mustard. ➢ Extraction & separation of Piperine from *Piper*. ➢ Extraction & separation of lycopene from *Lycopersicum*. ➢ Study of enzyme SDH and effect of inhibitor on its activity ➢ Extraction and estimation of vitamin C from suitable plant material		

M.Sc.	Semester IV Practical
RJSPGBOTPPBP303 Practical III Plant Biochemistry	**Course Outcomes** 1. Estimation of tryptophan and polyphenols. 2. Study of enzymes SDH and effect of inhibitors on its activity. 3. Extraction & separation of Glucosinolates from Mustard, Piperine from *Piper and* lycopene from *Lycopersicum.* 4. Study of enzyme activity **Learning outcome:** ➢ Know the importance and use of fats and oil, chlorophylls, tryptophan and polyphenols in plants. ➢ Understanding the biosynthesis and storage of secondary metabolite in plant cell and its commercial application

RJSPGBOTPPBP304	**Plant Physiology**	2
➢ Estimation of GOT from the given plant material ➢ Estimation of GPT from the given plant material ➢ Preparation of acid extract from any halophyte and estimation of sodium and potassium content by flame photometer ➢ Estimation of proline content from suitable plant material ➢ Study of superoxide dismutase (SOD) from suitable plant material ➢ Isolation and estimation of DNA ➢ Estimation of RNA by orcinol method ➢ Measurement and Characterization of Chlorophylls and Carotenoids by Spectroscopy at different stages of Senescence.		

M.Sc.	Semester IV Practical
RJSPGBOTPPBP 304 Practical IV Plant Physiology	**Course Outcome:** 1. Study of various enzyme assays and interpretations 2. Isolation and estimation of nucleic acids 3. Techniques of elemental analysis 4. Dynamics of stress induced enzymes **Learning outcome:** ➢ Application of all knowledge and interpretation ➢ Understanding the regulation of enzymes

Specialization: Molecular Biology, Cytogenetics and Biotechnology (MCB)

Course Code	Topic	Credits
RJSPGBOTMCB303	Plant Biotechnology	4
Unit I: Plant Tissue Culture and Commercial Aspects 1. Micropropagation of floricultural and medicinal plants using organogenesis and embryogenesis. 2. Factors responsible for *in vitro* and *ex vitro* hardening. 3. Plant improvement through soma clonal variations. 4. Plant cell cultures as chemical factories: Cell suspension, enhancement of product formation using biotic and abiotic elicitors, immobilization, permeabilization and product recovery. 5. Problems in plant tissue culture: Contamination, Phenolics and Recalcitrant. 6. The quest for commercial production from plant cell: scaling up of cell cultures,Shikonin production by *Lithospemum erythrorhizon* cell cultures.		1
Unit II: Industrial biotechnology down processing and techniques 1. Bioreactors: factors for bioreactor design, pneumatically agitated bioreactors, comparison of bioreactors, operating mode, batch, fed batch, semi continuous, two stage operation, continuous cultivation. 2. Factors for growth in Bioreactors. 3. General types of Industrial processes, list of antibiotics produced by fungi. Industrial production of penicillin 4. Industrial enzymes, Pectinase production as a case study 5. Single Cell Protein 6. Distillation, Floatation, Filtration, Centrifugation 7. Extraction methods: Solvent, absorption chromatography, gel filtration		1
Unit III: Environmental Biotechnology. 1. Biosorption: use of fungi, algae and biological components. 2. Biomass for energy: Sources of biomass, advantages &disadvantages, uses of biomass. 3. Biogas production from food processing waste: vegetable canning waste, flour, molasses etc. 4. Ethanol from biomass and Lignocellulosic residue. 5. Risks of GMO		1

Unit IV: Food Biotechnologyand biotransformation ➢ Factors affecting spoilage. ➢ Quality control of food. ➢ Enzyme immunoassays (ELISA). ➢ Radioimmunoassay (RIA), Monoclonal antibodies and DNA probes. ➢ Biotransformation using: Freely suspended plant cells and Immobilized plant cells. ➢ Biotransformation for Vanillin production from Capsicum cell cultures. ➢ In vitro storage of germplasm, Cryopreservation.	1

M.Sc. (MCB)	Semester IV Theory
RJSPGBOTMCB303 Paper-III Plant Biotechnology	**Course Outcome 3.3:** 1. Molecular biology techniques, aseptic techniques, safe handling of microorganisms and establishment of pure cultures 2. Preparation of cultures and stock solutions 3. Students will learn industrial processes of recovery important products by various processes. 4. Study of Food Biotechnology and its application for Quality control of food 5. Environmental issues like solid waste management and green fuel technology 6. Mass Propagation of plants using *in vitro* technique 7. Industrial production of fine chemicals using plant cell cultures **Learning outcome:** ➢ Industrial Biotechnology will enable students to learn the practical application of the subject. ➢ Learning the importance of Quality control of food. ➢ Application of techniques of plant tissue culture. ➢ To learn production of value-added chemicals by using green techniques like Biotransformation.

Course Code	Topic	Credits
RJSPGBOTMCB304	Molecular Biology and Cytogenetics	4
Unit I: Cytology and Cancer Biology 1. Cell membrane and permeability: Molecular models of cell membrane, cell permeability. Differentiation of cell membrane, intercellular communications and gap junctions. Cell coat and cell recognition, cell surface. 2. Cell Cycle and Apoptosis: Mechanism of Cell division; Regulation, Roles of Cyclins and Cyclin dependent kinases, Cell Plate formation, PCD. 3. Organization and function of mitochondrial and chloroplast genomes. 4. Cancer cells: Characteristics, division, spread, treatment. Course of cancer cell formation 5. Carcinogens: radiations, chemicals, Oncogenic virus. 6. Cancer and mutations, reproductive properties of transformed animal cell in culture, oncogenes, proto oncogenes and their conversion. Oncogenes and growth factors.		1
Unit II: Plant Breeding 1. Aims and objectives, plant introductions and acclimatization. 2. Selection – Mass, Pure line and Clonal. 3. Hybridization techniques, hybridization in self-pollinated and cross-pollinated plants. 4. Genetic control and manipulation of breeding systems including male sterility and apomixes. 5. Distant hybridization: In nature (plant breeding) – Barriers to the production of distant hybrids; Unreduced gametes in distant hybridization; Sterility in distant hybrids; Consequences of segregation in distant hybrids; 6. Applications and Achievements of distant hybridization in crop improvement; Limitations of distant hybrids.		1
Unit III: Immune System and Genetic Diseases 1. Phylogeny of immune system, innate and acquired immunity, nature and biology of antigens, major histocompatibility, complex cells of immune system, regulation of immune responses. Production of antibodies by plant cells and organs. 2. Immunity in Health and Disease: Immunodeficiency and AIDS 3. Genetic disorders, genetic counselling and gene therapy. 4. Biochemical disorders, sex linked disorders, cardiovascular disorders.		1
Unit IV: Molecular plant Breeding (Transgenic Crops) and Plant Genetic Engineering 1. Natural method of gene transfer (*Agrobacterium* and virus), selectable markers. 2. Artificial methods of gene transfer: Direct DNA uptake by protoplast, Electroporation, Liposome mediated and particle gun transformation 3. Production of Transgenic plants: Virus resistant & Herbicide –resistant,		1

plants, Bt Cotton, Golden rice. 4. Production of bio pharmaceuticals in transgenic plants. 5. Edible vaccines &Plant antibodies. 6. DNA-based molecular marker aided breeding: RAPD, RFLP, AFLP, STS, ISSR, Microsatellites.	

M.Sc. (MCB)	Semester IV Theory
RJSPGBOTMCB304 Paper-IV Molecular Biology and Cytogenetics	**Course outcome 3.4:** 1. Detailed study of plant breeding with hybridization techniques and its applications. 2. Mechanism of molecular plant breeding of transgenic crops 3. Detailed study of plant genetic engineering 4. Cell cycle, Programmed cell death 5. Organisation and functions of mitochondria and chloroplast genome **Learning outcome:** ➢ Understanding the mechanism of cancer biology and immunology ➢ Application in diagnostics ➢ Understanding the importance of plant breeding ➢ Understanding detailed concept of molecular plant breeding of transgenic crops ➢ Knowing the effect of plant genetic engineering and its applications

Practical	Plant Biotechnology	
RJSPGBOTMCBP303	1. Preparation of stock solution and medium preparation 2. Preparation of culture medium, stock solutions 3. Establishment of different types of cultures: callus, root, micro propagation 4. Visit to plant tissue culture laboratory 5. Types of Bioreactors 6. *Allium cepa* bioassay 7. ELISA and Flow Cytometry 8. Production of wine from different fruits and measurement of alcohol content 9. Removal of aromatic amines from water sample by using enzymes from suitable source	2
RJSPGBOTMCBP304	1. Microscopic identification of cancer cell 2. Genetic disorders 3. Visit to a diagnostic laboratory and report writing 4. Identify cultivars of any vegetable by Isoenzymes. 5. Culturing of Drosophila and study of genetic traits. 6. Blood group testing, Karyotypes of genetic disorders. 7. *Allium cepa* bioassay for screening of toxicants	2

M.Sc.	Semester IV Practical
RJSPGBOTMCBP303 RJSPGBOTMCBP304 Practical III and IV Plant Biotechnology	**Course Outcome:** 1. Hands on training in various aspects of plant tissue culture 2. Mass propagation of plants using tissue culture technique 3. Working on Aseptic techniques, safe handling of microorganisms and establishing pure cultures 4. Maintenance of cultures - Paraffin embedding, Lyophilisation. 5. Preparation of culture medium, stock solutions 6. Determination of cell number, viable count method (using pour plate and serial dilution technique). 7. Molecular Biology techniques **Learning outcome:** 1. Skill based training in plant tissue culture 2. Establishment and maintenance of culture 3. Understanding the application of molecular biology

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M. Sc Botany Syllabus Semester III

Scheme of Examinations

1. Internal Examination 40 marks various modes with different weightage (Presentation, seminar, mcq, quiz etc.)
2. One External (Semester End Examination) of 60 marks. Duration 2 ½ hours.
3. One Practical at the end of Semester consisting of Practical I 50 marks, Practical II 50 marks, Practical III 50 marks and Practical IV 50 marks separate passing in each practical
4. Minimum marks for passing Semester End Theory and Practical Exam is 40 %. Separate passing for Internal and Semester End examination.
5. For any KT examinations, there shall be ODD-ODD/EVEN-EVEN pattern followed.
6. Two short field excursions for habitat studies are compulsory. Field report submission is mandatory
7. Field work of not less than eight hours duration is equivalent to one period per week for a batch of 15students.
8. A candidate will be allowed to appear for the practical examinations if he/she submits a certified journal of Botany or a certificate from the Head of the department / Institute to the effect that the candidate has completed the practical course of T.Y. B.Sc. Botany as per the minimum requirements.
9. In case of loss of journal, a candidate must produce a certificate from the Head of the department /Institute that the practical for the academic year were completed by the student. However, such a candidate will be allowed to appear for the practical examination but the marks allotted for the journal will not be granted.
10. HOD's decision, in consultation with the Principal, shall remain final and abiding to all.

Evaluation and Assessment

Evaluation (Theory): Total marks per course - 100.

CIA- 40 marks

CIA 1: Written test -20 marks

CIA 2: Written Test / Assignment / Field Trip/mini project/ & Report -20 marks

Semester End Examination – 60 marks

Question paper covering all units

Evaluation of Practicals 200 marks (50 marks for each practical)

Course Semester End Examination in Semester III (RJSPGBOT301, RJSPGBOT302, RJSPGBOTPPB303/RJSPGBOTMCB303 & RJSPGBOTPPB304/RJSPGBOTMCB304)

Question	KNOWLEDGE	UNDERSTANDING	APPLICATION and ANALYSES	TOTAL MARKS- Per unit
Unit 1	06	03	03	12
Unit 2	06	03	03	12
Unit 3	06	03	03	12
Unit 4	06	03	03	12
Short notes from topics covering all the units	06	03	03	12
-TOTAL- Per objective	30	15	15	**60**
% WEIGHTAGE	50	25	25	**100%**

Evaluation of Practicals 200 marks/Semester

SEMESTER V: (50 marks for each practical RJSPGBOTP301, RJSPGBOTP302, RJSPGBOTPPBP303/ RJSPGBOTMCBP303 & RJSBOTPPPBP304/ RJSPGBOTMCBP304)

Continuous Evaluation of practical components which require adequate duration for completion of the task, observation and interpretation: 25%

Course end Practical Evaluation of skills of students in terms of skill, analysis, interpretation and conclusion.

M. Sc Botany Syllabus Semester III

ASSESSMENT OF BOTANY FIELD TRIP REPORT

Dept. of Botany Course Code_____ Date_____ Roll No _____

Name of student:_____ UID No_____

Marks____/20

Place of visit _____

Assessment Grid : Place one tick in each appropriate row. Overall mark should reflect the positions of ticks in the individual rows

(20)	**Field Trip and Report**	**80-100% 17-20 Marks**	**60-80% 13-16 Marks**	**40-60% 09-12 Marks**	**20-40% 05-08 Marks**
30% (06)	**Organization of report** -	Introduction about the location, vegetation, Botanical Names, Family, Local name, Description using Botanical Term, reporting all the species seen, Handwritten or typed. 6	Few mistakes, 5	Many mistakes 4	Inadequate presentation 3
50% (10)	**Content**	Excellent reporting of all the species observed in the field, ecological and morphological data, 10/9	Good reporting, species observed in the field but few of them missing in the list 8	Satisfactory, many species or relevant data missing from the report 6	Poor, inadequate and insufficient data or just a list of the species without any data. 5
10% (02)	**Conclusion** **----Marks----**	Conclusion based on self observation. Type of forest and vegetation 2	Good conclusion, comments not independent 2 / 1	Satisfactory, but insufficient 1 /0.5	Poor,irrelevant conclusion 0.5
5% (01)	**References** **----Marks----** -	Proper references, in required format 1	Proper references but no format 1	Few references 0.5	Irrelevant references 0
5% (01)	**Attendance / participation** **----Marks-----**	Attended and participated actively 1	Attended and participated 1	Infrequent Participation 0.5	No participation 0

Comments:

Name and Signature of Faculty.

Mini Project Under graduate level Dept. of Course Code _____Date_____

UIDNo_____Roll No_____Marks_____/20

Name of student ----------

Title of Assignment: _____

Assessment Grid : Place one tick in each appropriate row. Overall mark should reflect the positions of ticks in the individual rows. In boxes that have more than one set of marks, cancel out the marks that are not applicable and circle the correctmarks.

Project work and report (Parameters)	**Marks**	**80 – 100% Excellent**	**60 -80% Good**	**40 – 60% Satisfactory**	**20 – 40% Average**
Project work done	10	10 / 9	8 / 7	6 / 5	4 /3
Report writing and conclusions	10	10 / 9	8 / 7	6 / 5	4 /3

Mapping of the course to employability/ Entrepreneurship/skill development

Class	Course Name	Course Code	Topic focussing on Employability/ Entrepreneurship/skill development	Employability/ Entrepreneurship/ Skill development	Specific activity
S Y B Sc Botany	Plant Diversity I	RJSUBOT301, RJSUBOT401	Plant Diversity III,IV focuses on identification of plants ranging from microbes	The topics focuses on identifying plants ranging from lower forms Thallophyta till	Preparation of bio fertilizers
S Y B Sc Botany		RJSUBOT301 RJSUBOT302 RJSUBOT303	Concepts in Plant Anatomy, Biochemistry, Physiology, Genetics and Ecology which are essential to take up a career in research and teaching since these provide the Domain knowledge. Medicinal Botany gives a glimpse on plant based drugs and economically important products	Employability in field of the teaching and research. To learn the techniques to identify plant based drugs.	
S Y B Sc Botany	Practicals	RJSUBOTP301 RJSUBOTP302 RJSUBOTP303 RJSUBOTP301 RJSUBOT302 RJSUBOT303	Microscopical identification of lower forms of plants, identification of higher forms using morphological studies. Study of plants in different habitats and their adaptation. Plant pigments as natural pH indicator	1Analytical skills 2Interpretation skills 3Writing skills	Miniproject for developing Entreprenuerial skills, Field trips enhances skills of identification of plants in situ, organisational skills, team work.