



P. G. PROGRAMME IN BIORESOURCES

SCHOOL OF BIOLOGICAL SCIENCES

UNIVERSITY OF KASHMIR, SRINAGAR

Syllabus of New Value Added Courses with Employability, Entrepreneurship and Skill Development introduced from 2013-2018

MODIFIED CHOICE BASED CREDIT SYSTEM (CBCS) SCHEME AND COURSE STRUCTURE

The revised syllabi for P.G. Programme in Bioresources as per the Modified Choice Based Credit System (CBCS) Scheme adopted by the University for implementation at Post-Graduate level from the academic session 2017 and onwards is as under:

Core Courses (CR): There are 3 Core Courses per semester i.e 12 courses for 4 semesters. Each course is of 4 credits. A student has to take 3 CR Courses per semester to obtain 12 credits from CR Courses per semester.

Discipline Centric Elective Courses (DCE): There are 7 Discipline Centric Elective Courses, each having 4 credits and Project Work of 4 credits. **Term Work** is to be taken by the students in 4th semester.

A student has to obtain 8 credits per semester from DCE Courses.

The CR Courses and DCE Courses are exclusively meant for the Department's own students.

Generic Elective Courses (GE): There are 8 GE Courses, each course having 2 credits. The GE Courses are meant for the students of the sister Departments in the School of Biological Sciences.

Open Elective Courses (OE): There are 4 OE Courses, each course having 2 credits. OE courses are meant for students of all other Departments, except School of Biological Sciences.

A student has to obtain 4 credits from GE and OE courses per Semester. A student can take 2 or 4 credits from GE and 0 or 2 credits from OE courses.

To obtain M.Sc degree in Bioresources a student has to obtain 24 credits in each semester and 96 credits in 4 semesters.

The Course Structure and credit break up has been given in tabulated form.

One credit means one hour of teaching/ tutorial or two hours of practical work/field work per week, for 16 weeks in a semester equivalent to 90 actual teaching days.

Abbreviations

L	Lecture
T	Tutorial
P	Practical
CR	Core Course
DCE	Discipline Centric Elective
GE	Generic Elective
OE	Open Elective



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BR17005GE: Biomedicine and Bioprospecting

Unit: I

Biomedicine: Introduction, present scenario & future prospectus; Sources of drugs (plants, animals, microorganism, drugs from organic synthesis); Historical development and present status of Chinese/ Amchi, Ayurvedic, Unani Sidha and Homeopathic systems of medicine.

Unit: II

Ethnobotany: Concept; Ethnobotanical and medicinal importance of some important medicinal plants of Kashmir viz. *Arnebia benthamii*, *Aconitum heterophyllum*, *Atropa acuminata*, *Podophyllum hexandrum*, *Saussurea costus*, *Rheum emodi*, *Digitalis purpurea*, *Valeriana jatamansii*, *Viola odorata*, *Picrorhiza kurroa*, *Dioscorea deltoidea* and *Hippophae rhamnoides*.

Unit: III

Herbal crude medicines: Classification, collection and processing; Various separation techniques for extraction of crude medicine, advantages and limitations; Plant drug standardization; Quality control and quality assurance of herbal drugs; Drug acts and rules.

Unit: IV

Bioprospecting: Concept and methods of bioprospecting; Role of traditional knowledge in bioprospecting; Biopiracy, case studies of biopiracy (Basmati, Neem, Turmeric, Periwinkle, Enola bean); Traditional Knowledge Digital Library (TKDL)— concept and importance.



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BR17001GE: Microbial Resources

Unit: I

Microbial resources— historical perspective; Types of microbial resources (algal, fungal, bacterial, viral); Approaches for the assessment of microbial diversity (culture dependent and independent); Morphology and ultrastructure of bacteria and viruses (bacteriophages); Microbial growth and growth curve.

Unit: II

Role of microorganisms in food production and beverages (wine, beer, bread, cheese); Single Cell Proteins— production and utility; Microbes as sources of antibiotics and therapeutic agents; Major commercial microbial products (amino acids, enzymes, steroids and biopolymers).

Unit: III

Bioremediation; Role of microbes in bioremediation of soil and water; Role of microbes in waste water treatment (processes based on attached microbial growth, activated sludge process).

Unit: IV

Role of microbes in biogeochemical cycles (carbon, nitrogen, sulphur & phosphorus cycle); Microbes as bioindicators; Phycoviruses and algal blooms; Biodefence and bioterrorism.



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BR17003GE: Industrial Entomology

Unit: I

Apiculture: Importance and scope; Bee species (biology, morphology, behaviour, and habitat); Bee keeping equipment, hives, bee pasturage and seasonal management; Honey extraction; Factors affecting honey yield; Properties and uses of honey; Granulation, fermentation and storage of honey; Uses of other bee products; Bee enemies including diseases and their control.

Unit: II

Sericulture: Silkworm species, systematic position and salient features; Rearing techniques of mulberry, muga, eri and tassar silkworms; Nutritional requirements of silkworms; Sericulture rearing house and appliances; Grainage technology and cocoon marketing; Enemies and diseases of silkworms and their management; By-products of sericulture.

Unit: III

Lac culture: Lac insect, biology and habitat; Host trees— pruning, inoculation, lac cropping techniques and harvesting; Enemies of lac insect and their control; Processing techniques of lac (traditional and modern); Physical and chemical characteristics of lac.

Unit: IV

Beneficial Insects: Insects as pollinators and biocontrol agents; Insects as soil fertility improving agents and scavengers; Use of insects and insect products in medicine; Use of insects in scientific investigations; Use of insects as food source.



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BR17006GE: Biocontrol and Crop Management

Unit: I

Biocontrol: Importance and scope; Biological control agents— predators, parasitoids and pathogens; Classical biological control— principles and procedures; Conservation biological control— conservation, habitat management and augmentation; Mass multiplication methods and effective evaluation techniques of biocontrol agents.

Unit: II

Plant disease management: Principles of plant disease management; Organic amendments and botanicals to control plant disease; Disease resistance and molecular approach for disease management; Fungicides, bactericides and antibiotics in disease management; Nature, properties and mode of action of antifungal, antibacterial and antiviral chemicals.

Unit: III

Post harvest diseases: Concept of post harvest diseases; Importance with reference to environment and health; Postharvest management; Cultural practices in perpetuation of pathogens; Phytoextracts in controlling post-harvest diseases and improving the shelf life of produce.

Unit: IV

Integrated Pest Management (IPM): History, concept and principles; Components of IPM— host plant resistance, agronomic manipulations, mechanical, physical, chemical, biological, genetic and behavioural control methods; Economic Threshold Levels (ETL), Economic Injury Levels (EIL) and their determination



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BR15305GE: Wood Resource Utilization

Unit: I

Introduction: Wood as a resource; Wood Structure- Wood elements in gymnosperms, monocots and dicots; Formation of wood in gymnosperms and dicots.

Wood growth: Formation of wood cambium and its derivatives, secondary xylem; Growth rings, Properties of secondary xylem; Soft wood and hard wood, sap wood and heartwood, knots; Reaction wood.

Unit: II

Physical properties of wood: Colour, luster, odour, weight, and density; Variation in density of early and late wood constituents, effect of growth rings on density.

Chemical properties of wood: Cellulose & hemi-cellulose— structure, chemical properties, effect of acids and bases; Lignin— structure and chemical properties; Wood extractives.

Unit: III

Wood deterioration and preservation: Wood boring insects— termites and carpenter ants; Wood destroying fungi; Wood preservation processes — non pressure and pressure processes; Wood preservative.

Wood seasoning: Concept & importance; Air seasoning— air drying, accelerated air drying; Special seasoning methods— drying by boiling in oily liquids and vacuum drying.

Unit: IV

Commercially important wood species in Kashmir: Description, habitat, type of wood and uses of pine, deodar, silver fir, willow, poplar and walnut.

Wood products: Wood as fuel; Saw dust and its uses, wood pellet technology, Wicker works and their importance as sources of income in Kashmir; Wood resources and sports items; Water resistant woods, Wood as timber, Plywood.



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Practical Work:

- Morphology of important wood species of Kashmir Kashmir Himalayas.
- Study stem anatomy hard and soft wood species.
- Study various types of wood elements in gymnosperms and angiosperms.
- Study resin canals in gymnosperms.
- Study Physical properties of wood.
- Extraction of cellulose from a given sample of plant material.
- Proximate analysis of various samples wood.



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BR17002GE: Algal Resources

Unit: I

Algae: Introduction, habit and habitat, micro and macro-algae; Distribution in soil, freshwater and marine habitats; Contribution in primary productivity; Immobilized and inactivated algal biomass for metal and nutrient removal.

Unit: II

Algae as food and fodder: Algae as a source of vitamins, proteins, lipids, carbohydrates, minerals and iodine; Algae as fodder for cattle and poultry, seaweeds as animal feed; Agar agar, alginates and carrageenin.

Unit: III

Algae in pharmaceuticals: Algae as source of antimicrobials, antivirals and antifungals, neuroprotective proteins, therapeutic proteins and drugs; Use of algae in the light of modern research— as antioxidants and anticancer agents; Use of algae in forensic medicine research and HIV vaccine model.

Unit: IV

Algal biofuels and biofertilizers: Energy and chemicals; Biodiesel, hydrogen production-mechanism, progress and prospects; Mechanism of biological nitrogen fixation by cyanobacteria; Cyanobacteria as biofertilizers for paddy cultivation, reclamation of usar lands.



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BR17004GE: Bioresource Management

Unit: I

Bioresource management: Exploitation of bioresources and sustainable development; Forest resource management (social forestry, agro forestry and NWFPs); Grassland management; Freshwater & marine bioresource management; Wildlife management.

Unit: II

Monitoring biodiversity: Methods for monitoring biodiversity trends; Mega biodiversity zones and global biodiversity hotspots; Threats to biodiversity, species extinction; IUCN threat categories, Red data book.

Unit: III

Conservation programmes: Principles and strategies of biodiversity conservation; *In situ* and *ex situ* conservation strategies; Role of remote sensing and geographical information system in biodiversity studies; Principles and methodologies for soil conservation and restoration; Biovillages.

Unit: IV

Acts and policies: Forest Conservation Act 1981; Environment (protection) Act 1986; Hazardous waste (Management and Handling) Rules 1989; Bio-Medical Waste (Management and Handling) Rules 1998; Environmental Impact Assessment (EIA); Environmental Management Plan (EMP) and Environmental Clearance for Establishing Industry (ECEI); National Biodiversity Action Plan National Biodiversity Act 2002.



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BR17004GE: Bioindustries

Unit: I

Industrial revolution: Causes and consequences; Industrial economic sectors: Primary, Secondary, Tertiary and Quaternary Sectors; Small scale industries and their importance; Entrepreneurship— concept, entrepreneurial skills; Self employment.

Unit: II

Bioindustries: Concept and scope; Role of natural resources in economic development.

Bioindustries in India: Status and scope of agriculture, fisheries, sericulture, forest and dairy industry.

Unit: III

Fruit industry in J & K: Status and scope; Fresh and dry fruits—harvest, processing & storage and marketing.

Potential bioindustries in J & K: Apiculture, tannery, pisciculture, ornamental horticulture and herbal drug industry.

Unit: IV

Sustainable development: Concept, indicators of sustainable development; Quality assurance and quality control; Policies responsible for development of bioindustries. Intellectual Property Rights— concept and importance.



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BR17007GE: Biocosmetics

Unit: I

Biocosmetics: History of biocosmetics; Importance of plant and animal resources in biocosmetics; Global market of biocosmetics; Manufacture and import of biocosmetics; Labelling, packaging and standardization of biocosmetics; Scope of biocosmetics industry in Jammu and Kashmir.

Unit: II

Skin cosmetics: Skin and hand creams; Facial skin care; Body lotions and bath time herbs; Sun screen products, skin tonics and anti-acne creams; Botanicals in skin care.

Unit: III

Hair cosmetics: Formulation of shampoos, surfactants and conditioners; Types of shampoos with emphasis on herbal shampoos; Hair colourants, fixers, sprays and gels; Botanicals in hair care.

Unit: IV

Perfumes and fragrances: Selection of fragrance; Raw material used in the preparation of fragrance; Fragrance and allergenicity, water soluble fragrances; Aromatherapy (Historical perspective, essential oils, aromatherapy for stress relief, weight loss and beauty aid).



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BR17001OE: Human Health and Plant Diet

Unit: I

Introduction: Plants in the diet of hunter gatherers; Plants in modern western diet; Plants as sources of proteins, carbohydrates, fats, vitamins and minerals.

Unit: II

Good things from plants in the diet: Fibre, Antioxidants; Gut microbiotome; Role of phytonutrients in influencing gut microbiotome.

Unit: III

Plants as source of healthy diet: Natural health products; Algae and fungi as source of human food; Plant diet in pregnancy, lactation, infancy, childhood and adolescence.

Unit: IV

Plant diet and diseases: Impact of food matrix and phytonutrients against chronic diseases; Plant diet and disease management— diabetes, heart disease, cancer, obesity; Plants in nutrition fitness and sports; Food safety; Food poisoning.



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BR17008GE: Organic Farming

Unit: I

Organic agriculture: Principles of organic agriculture; Objectives and requirements of organic standards; Criteria for substances used in organic production and processing; Standard for organic production and processing; Organic certification; Organic farming and food security.

Unit: II

Organic crop production: Split production and parallel production; Crop production and conversion period; Diversity in crop production; Soil fertility and fertilization; Pest, disease and weed management; Breeding of organic varieties.

Unit: III

Organic animal husbandry: Animal management; Animal origin and conversion period; Breeds and breeding; Mutilations; Animal nutrition; Veterinary medicine; Transport and slaughter; Bee keeping.

Unit: IV

Vermiculture and vermicompositing: Species selection, environmental requirements; Vermicompositing—methods, materials and advantages; Role in soil fertility, plant growth promotion and disease management.



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BR15003OE: Infectious Diseases and Livestock Health

Unit: I

Nature and Consequences of Parasitism: Parasitology, types of parasites, life cycle of different parasites, Host Parasitic associations; Parasitic adaptations; morphological and physiological adaptations; Host parasite interaction, Effects on the Parasite, Effects on the host; Zoonosis- Classification (reservoir host, etiological agent and type of life cycle).

Unit: II

Bacterial Diseases in Livestock: Anthrax Aetiology, Pathogenesis, Diagnosis and Control; Salmonellosis (Gastroenteritis) Pathogenesis, Diagnosis and Control; Avian Cholera Aetiology, Pathogenesis, Diagnosis and Control; Brucellosis, Pathogenesis, Diagnosis and Control.

Unit: III

Viral and Fungal Diseases in Livestock: Foot & Mouth Disease Distribution, Pathogenesis and Control; Bluetongue disease Distribution, Pathogenesis and Control; Bird flu Distribution, Pathogenesis and Control; Aspergillosis, Aetiology, Epidemiology, Pathogenesis, Diagnosis and Control.

Unit: IV

Protozoan And Helminth Diseases in Livestock: Parasitic protozoans of Livestock with special reference to Pathogenicity and Prophylaxis of Babesia; Nematode parasites of Sheep with special reference to life cycle, pathogenicity and control of *Haemonchus contortus*; Morphology life cycle, Pathogenicity, prophylaxis and control of *Fasciola hepatica*; Cestode parasites of ruminants with reference to the life cycle, pathogenicity, prophylaxis and control of *Moneiza expansa*.



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BR17002OE: Infectious Diseases and Human Health

Unit: I

Introduction to Infectious Diseases: Basic concepts in pathophysiology of infectious diseases, Outline of physiological mechanisms leading to diseased state, Infectious disease transmission, Infection and immunity, Acute and chronic Infections, Major infectious diseases of humans.

Unit: II

Bacterial Infections: Pathogenesis, mechanisms of pathogenesis; transmission, epidemiology, public health implications, diagnosis, prophylaxis and treatment of major human infections (Tuberculosis, Cholera, Typhoid).

Unit: III

Viral Diseases: Pathogenesis, mechanisms of pathogenesis; transmission, life cycle, epidemiology, public health implications, diagnosis, prophylaxis and anti-retroviral therapy of Human immunodeficiency virus (HIV/AIDS); Sexually transmitted diseases.

Unit: IV

Fungal and Protozoan Diseases:

Pathogenesis, mechanisms of pathogenesis; transmission, life cycle, epidemiology, public health implications, diagnosis, prophylaxis and treatment of major Fungal human pathogens: (Dermatophytes, Candida, Aspergillus); Protozoal human pathogens (Plasmodia and Trypanosoma).



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BR17404DCE: Bioinformatics

Unit: I

Bioinformatics databases: Bioinformatics— concept and application; Types of databases- Genome (NCBI, EBI, TIGR, SANGER), Nucleic acid (EMBL, GeneBank, DDBJ), Protein (SwissProt, TrEMBL, PIR) databases; Structural classification of proteins (SCOP, CATH).

Unit: II

Sequencing: Conventional and next generation sequencing; Basic Concept of sequence similarity, identity and homology; Sequence based database searches (blast, fasta, gcg, msf, nbrf-pir etc.); Homologues, orthologues, paralogues; Sequence alignment (pair-wise and multiple); Gene finding and genome annotation; **Transcriptomics:** DNA Microarray, Serial analysis of gene expression, Qualitative RT PCR.

Unit: III

Emerging areas of bioinformatics: Computational systems biology, semantic web; Bioontologies (types, application, softwares), annotations; Proteomics— separation, identification of proteins, MS-MS, protein microarray, protein expression profiling, protein- protein interaction mapping; Metabolomics, cheminformatics, phenomics.

Unit: IV

Phylogenetics: Morphological & molecular phylogeny; Representation of molecular phylogeny; Methods of phylogeny— maximum parsimony, likelihood and Bayesian method; Distance methods (UPGMA, NJ); Softwares (PHYLIP, Tree base, Mesquite, NTSY Spc).



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Practical Work:

- Role of NCBI, EBI, TIGR and SANGER in maintaining sequence data.
- Demonstration of BLAST and FASTA.
- Study Pairwise and Multiple sequence alignments.
- Demonstration of MSA.
- Construction of Phylogenetic trees using morphological and molecular data.
- Tools for obtaining information about primary structure of proteins.