DEPARTMENT OF BOTANY (NORTH CAMPUS)

UNIVERSITY OF KASHMIR

SEMESTER-III

Five-Year Integrated Masters Programme (FYIMP) in Botany

DEPARTMENT OF BOTANY (NORTH CAMPUS)
UNIVERSITY OF KASHMIR

SEMESTER-3				
Course Type	**Course Code**	**Course Title**	**Credit**	
			Theory	**Practical**
MAJOR-1	IBOTMJAR0323	Archegoniate (Bryophyta, Pteridophyta & Gymnosperms)	3	1
MAJOR-2	IBOTMJPP0323	Plant Physiology	3	1
MINOR	IXXXMNAB0323	Animal Behaviour and Wild life	3	1
Multidisciplinary	IXXXMDBR0023	Bio-Industries	3	0
	IXXXMDES0023	Environmental Issues and Sustainability		
Ability Enhancement	IXXXAEKL0023	Kashmiri Language	3	0
	IXXXAEAL0023	Arabic Language		
Skill Enhancement	IXXXSEST0323	Seed Technology	0	2
	IXXXSEMC0323	Mushroom Cultivation		
Total			**20**	

Semester	:	**III**
Course Type	:	**Major-1**
Course Title	:	**Archegoniatae (Bryophyta, Pteridophyta & Gymnosperms)**
Course Code	:	**IBOTMJAR0323**
Credits	:	**04 (Theory: 03; Practical: 01)**

COURSE OBJECTIVES: *To impart understanding on the classification, occurrence and habit of bryophytes, pteridophytes, gymnosperms and some fossil species. The course also helps in understanding the potential of this group of plants for economical utility and phylogenetic relationship of these groups.*

LEARNING OUTCOME: *The students* after completion of this course have a deep understanding of the origin, evolution, economic importance and diversity of lower plants (bryophytes, pteridophytes, gymnosperms). The students shall have clear idea on the nature of reproduction in this group of plants and will be able to identify the various species of these groups for conservation and utilization.

Theory (03 Credits)

UNIT I:

Bryophytes: General characteristics of bryophytes, Main criteria for classification of bryophytes, morphology, anatomy and reproduction (excluding developmental details) of *Marchantia, Antheceros* and *Funaria*; Evolution of sporophyte; apogamy and apospory; alternation of generation; economic importance of bryophytes.

UNIT II:

Pteridophytes: General characteristics of pteridophytes; criteria for classification of pteridophytes (Parihar 1996); morphology, anatomy and reproduction (excluding developmental details) of *Equisetum* and *Selaginella*; heterospory and origin of seed habit; evolution of stellar systems in pteridophytes.

UNIT III:

Gymnosperms: General characteristics of gymnosperms, criteria for classification of gymnosperms. Distribution of gymnosperms in India; morphology, anatomy and reproduction (excluding developmental details) of *Cycas* and *Pinus*; evolutionary and economic importance of gymnosperms

Practical Exercise (01 Credit)

- Study of vegetative and reproductive structures of *Marchantia* and *Funaria* through temporary slides and permanent slides.
- Study of vegetative and reproductive structures of *Selaginella* and *Equisetum* through temporary slides and permanent slides.
- Study of vegetative and reproductive structures of *Cycas* and *Pinus*- through temporary slides and permanent slides

Suggested Readings

- Pteridophyta (vascular cryptogams) by Dr.P.C.Vashista,Dr.A.K.Sinha,Dr. Anil Kumar.
- Diversity of microbes and cryptograms and seed plant diversity and sytematics) by S.P.Pandey and S.K.Verma Pradeeps Botany by Dr.H.N. Shrivasta Vol-III.
- Gymnosperms by Dr.P.C.Vashista,Dr.A.K.Sinha,Dr Anil Kumar
- Bryophyte text book by Dr. O.P Sharma.

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Semester	:	**III**
Course Type	:	**Major-2**
Course Title	:	**Plant Physiology**
Course Code	:	**IBOTMJPP0323**
Credits	:	**04 (Theory: 03; Practical: 01)**

COURSE OBJECTIVES: *To provide students an understanding of the core topics and advanced integrated knowledge in plant physiology, concept and mechanism of various physiological processes viz., water and nutrient uptake, transport, photosynthesis, respiration and plant hormones.*

LEARNING OUTCOMES*: Students will be able to understand various physiological life processes in plants and also gain knowledge about the various uptake and transport mechanisms in plants and coordination of various processes. Learners are expected to understand the role of various hormones, photosynthetic pigments and different pathway of anabolism and catabolism.*

Theory (03 Credits)

UNIT I:

Plant water relations: Physicochemical properties of water, Water potential and its components; Water absorption by roots; Root pressure and guttation; Ascent of sap; Transpiration and its significance; Factors affecting transpiration; Pressure flow model; Phloem loading and unloading.

Mineral nutrition: Essential elements, macro- and micro-nutrients; criteria for essentiality of elements: Role of essential elements; Symptoms of mineral deficiency; Transport of ions across cell membrane; Active and passive transport.

UNIT II:

Photosynthesis: Pigments (Chlorophyll- a, Chlorophyll- b, Xanthophylls, Carotenes); Absorption and action spectra of pigments; Quantum requirements in photosynthesis, red drop and Emmerson enhancement effect; Photosynthetic electron transport and mechanism of ATP synthesis (Photophosphorylation); C3, C4 and CAM pathways of carbon fixation; Photorespiration.

Respiration: Aerobic and anaerobic respiration; Glycolysis, TCA cycle; Electron transport system and oxidative phosphorylation (Chemiosmotic hypothesis);

UNIT III:

Plant growth regulators: Discovery, structure and physiological roles of auxins, gibberellins, cytokinins, abscisic acid and ethylene.

Plant response to light and temperature: Photoperiodism (SDPs, LDPs, Day neutral plants); Discovery and structure of phytochromes and cryptochromes; Red and far-red responses of phytochrome; Vernalization; Seed dormancy and germination

Practical Exercise (01 Credit):

- Determination of osmotic potential of plant cell sap by plasmolytic method.
- To study the effect of environmental factors (light and wind) on transpiration of excised twig.
- Calculation of stomatal index and frequency of a mesophyte and a xerophyte.
- To demonstrate the ascent of sap in young plant seedling using eosin solution.
- Demonstration of Hill reaction.
- Separation of photosynthetic pigments by paper Chromatography.
- Separation of photosynthetic pigments by Thin Layer Chromatography (TLC).

Suggested Readings

- Taiz, L., Zeiger, E., Moller, I.M. and Murphy, A. 2015. Plant Physiology and Development (6th edition). Sinauer Associates Inc. USA.
- Taiz, L., Moller, M., Murphy, A. andZeiger, E. 2022. Plant Physiology and Development (7th Edition).Sinauer Associates, Inc. Publishers, USA.
- Hopkins, W.G. and Huner, A. 2008. Introduction to Plant Physiology. John Wiley and Sons. U.S.A. 4th edition.
- Mohr Hans, Schoper. P and Gamon A. 2019. Plant Physiology (5th edition). Springer
- Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology (4th Edition). Wadsworth Publishing Company, Inc. California, USA.
- Srivastava, L. M. 2002. Plant Growth and Development: Hormones and Environment (1st edition). Academic Press, USA.
- Bhatia, K.N. 2019. Plant Physiology & Metabolism for 4th Semester. Trueman's Publication. Trueman Book Company, Jalandhar.
- Singh, K., Thakur, A.K, Bassi, S.K. and Shah, I. A. 2017. Plant Physiology & Metabolism for 4th Semester. Danish Publication. S. Danish & Co. Jalandhar.
- Jain. V. K. 2011. Plant Physiology. New Age International Publishers
- Sastri R. K. 2017. Plant Physiology.Cengage Learning, India
- Bajracharya D. 1999. Experiments in Plant Physiology-A Laboratory Manual. Narosa Publishing House, New Delhi.
- Sharma, O.P and Dixit Shivani. 2008. Practical Botany –III. PragatiPrakashan, Meerut, India.

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Minor Courses for Five-Year Integrated Masters Programme (FYIMP) in Botany

Semester	:	**III**
Course Type	:	**Minor-3**
Course Code	:	**IXXXMNAB0024**
Course Title	:	**Animal Behaviour and Wildlife**
Credits	:	**04 (Theory: 03; Practical: 01)**

LEARNING OBJECTIVE: *To develop a deeper understanding of how animals interact with each other and their environment*
LEARNING OUTCOMES*: The knowledge will be utilized to promote animal conservation and improve their well-being*

Theory (03 Credits)

UNIT I:
Social organization in insects; Parental care in vertebrates; Communication in animals: auditory, visual, chemical and tactile

UNIT II:
Courtship and mating systems; Learning behaviour in vertebrates; Migration in fishes, Migration in birds

Unit III:
Wildlife: concept, definitions and importance; Wildlife conservation: in situ and ex situ; National Organizations involved in wild life conservation; Conservation projects in India: Tiger and Hangul

Laboratory Exercise (01 Credit):

- Field surveys for studying various types of behaviours in animals
- Study of social organisation in bees/ants through audio-visual aids
- Collection and identification of various social insects
- Study of parental care & social behaviour through audio-visual aids
- Identification of local mammalian & avian fauna

Suggested Readings:

- Animal Behaviour by John Alcock
- Animal Behaviour by ReenaMathur
- Animal Ecology and Distribution of Animals by Rastogi and Jayaraj
- Managing our Wildlife Resources by S. A. Anderson
- Fundamentals of Wildlife Management by Rajesh GopalNatraj Publishers, Dehradun India

Multidisciplinary Courses for Five-Year Integrated Masters Programme (FYIMP) in Botany

Semester	:	**III**
Course Type	:	**Multidisciplinary Course (MDC)**
Course Code	:	**IXXXMDBR0023**
Course Title	:	**Bio-resources (Bio-industries)**
Credits	:	**03 (Theory: 03)**

Theory (03 Credits)

Unit I:

Introduction to Bioindustry: Bioindustry- Concept and recent trends in the development of Bioindustry; Scope and status of Bioindustries in India (Dairy, Sheep, Floriculture); Scope and status of Bioindustries in J &K (Dairy, Sheep, Aquaculture, Horticulture, Cosmetics, Fertilizers, Leather, aquaculture, Ornamental horticulture and Herbal Medicine); Agriculture crop production trends and demand for staple food.

Unit II:

Bio-based waste utilization: Composting, vermicomposting- methods, materials and advantages; Pulping (mechanical and chemical pulping); Municipal wastes- segregation and uses; Bio-based plastics and fibres; Biomass as energy source, Biogas production, Bio-fuels-Concept and classification. Concept of Bio-villages and biotechnological parks

Unit III:

Green economy and Entrepreneurship: Marketing strategies for Bioresources products, Product launching, evaluation and advertisements, value addition; Entrepreneurship, Small Scale Industries, Self-employment schemes in relation to bioindustries; Status and scope and of establishing bio-based small scale industries Concept of Green entrepreneurship. Intellectual property rights (Patents, Copy Rights, & Trademarks);

Suggested Readings:

- Entrepreneurship: New Venture Creation, David H. Holt
- Entrepreneurship and Small Business Management: C.B. Gupta, S.S. Khanka.
- Vermiculture and Organic Farming. Sathe, T.V. (2004) Daya publishers.
- Bio-fertilizers and organic Farming Vayas S.C, Vayas, and Modi, H.A. (1998).
- Principles of Intellectual Property. N.S. Gopala Krishnan & T.G. Agitha, (2009) Entrepreneurial Development by S.S. Khanka (S. Chand).
- Intellectual property rights in the WTO and developing countries. Watal J (2001).

Multidisciplinary Courses for Five-Year Integrated Masters Programme (FYIMP) in Botany

Semester	:	**III**
Course Type	:	**Multidisciplinary Course (MDC)**
Course Code	:	**IXXXMDES0023**
Course Title	:	**Environmental Issues and Sustainability**
Credits	:	**03 (Theory: 03)**

COURSE OBJECTIVES & LEARNING OUTCOMES: *This course is designed to offer a comprehensive understanding of basic environmental issues, drivers of environmental change and management perspective. Furthermore, this paper will help the students to understand key governance and policy interventions needed to improve the wellbeing of the environment. This course will also highlight the role of citizens and eco-movements to achieve the objectives of sustainability.*

Theory (03 Credits)

UNIT I:

Global Environmental Issues: Global warming and climate change, Human population explosion, Desertification, Ozone layer depletion, Acid precipitation, Global biodiversity loss

UNIT II:

Environmental Governance and Policy: Concept of environmental governance and environmental literacy, Environmental governance at global level (institutional arrangements), Role of NGO's and corporate in environmental decision making, Constitutional provisions for environmental protection (article 21, 48A, 51A (g)), National Environment Policy-2006

UNIT III:

Environmentalism, Citizen Science and Sustainability: History and development of environmentalism (Biocentrism, Anthropocentrism, Eco centrism), Environmental movements (Greenbelt movement, Chipko, Narmada bachao andolan), Role of citizen science to foster environmental protection, Concept of Environmental justice and stewardship, Ecological footprint and sustainability, Sustainable development goals (overview)

Suggested Readings:

- Global Warming and Climate Change: Dr. S K Agarwal.
- Text Book of Environmental Studies for UG Course: E. Bharucha
- Biodiversity: K.C. Agarwal
- Atmospheric pollution and climate change: Dr. P C Sinha.
- Population Ecology: P.S. Aaradhana
- Environmental Science: Jackson & Jackson
- Global & General Environment: H.D. Kumar, Swati Kumar
- Environmental Science: Enger and Smith
- Basics of Environmental Science: Michael Allaby
- Environmental Education (Scientific, Social and Legal Aspects) : H. M. Dami
- Environmental Problems, Policies and Strategies: Jai Prakash; S. K. Srivastava.

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Ability Enhancement Courses for Five-Year Integrated Masters Programme (FYIMP) in Botany

Semester	:	**III**
Course Type	:	**AEC**
Course Title	:	**Kashmiri Language**
Course Code	:	**IXXXAEKL0023**
Credits	:	**03**

Course Objectives:

After the completion of the course the students will be able :-

1.) To develop understanding of the significance of the Kashmiri language as a subject in the linguistic diversity of the nation and UT of J and K.

2) To familiarize with the segemental phonemes of Kashmiri & Persio- Arabic Script.

3) To acquaint with the parts of speech & their usage in colloquail kashmiri.

4) To have understanding of the nature , characteristics & functionality of Mother Tongue as well as its use in the day to day life.

یونٹ:I کأشر زبان

(ا) زبان تہ اہمیت:

(ب) کأشر زبانہ ہُند آگر تہ مُختلف نظریہ

یونٹ:II کأشر صوتیات

(ا) کأشری مصوتہ: ورتاوتہ وضاحت

(ب) کأشری مصمتہ: ورتاوتہ وضاحت

یونٹ:III کأشر گرامر: بُنیادی زان

(ا) ناوُت، پُڑی ناوُت ، کرِاوُت تہ باوُت

(ب) جُملہ: سادہ جُملہ، مرکب جُملہ تہ پیچیدہ جُملہ

(ج) پیراگراف، مضمون تہ چٹھی

امدادی کتابہ :

ا: شفیع شوق، کأشر یک گرایمر: علی محمد اینڈ سنز سری نگر

۲: شفیع شوق، کأشر ادبک توأریخ: ترتیم اشاعت، کشمیری ڈپارٹمنٹ

3. T.R.Wade, A Grammar of The Kashmiri Language.

4.Shafqat Altaf, Foreign Influences on Kashmiri Vocabulary:A Cultural Account

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Ability Enhancement Courses for Five-Year Integrated Masters Programme (FYIMP) in Botany

Semester	:	**III**
Course Type	:	**AEC**
Course Title	:	**Arabic Language**
Course Code	:	**IXXXAEAL0023**
Credits	:	**03**

Unit - I

1. اللغة العربية: تعريف وجيز
2. حروف الهجاء (لأشكال ولأصوات)
3. حروف العلة والصحيحة
4. الحركات الثلاث والسكون والشدة والمدّة
5. الحروف الشمسية والقمرية

Unit - II

1. الكلمة وأنواعها (اسم وفعل وحرف)
2. المعرفة والنكرة
3. المذكر والمؤنث
4. المفرد والمثنى والجمع
5. أسماء لإشارة

Unit - III

Following lessons from the prescribed book:

1. التحية والتعارف (الدرس لأول)
2. حوار في الفصل (الدرس الثاني)
3. هذا بيتي (الدرس الثالث)

Book Prescribed:

1- الممتاز في الحوارات اليومية لغير الناطقين بالعربية، إعداد: مركز بيسا لتعليم العلوم الإسلامية واللغة العربية.

Books Recommended:

1- Arabic for beginners, Dr Syed Ali
2- A new Arabic Grammar, John A. Haywood
3- Essential Arabic, I. A. Faynan
4- Teach Yourself Arabic, S. A. Rahman
5- Arabic Made Easy, Abul Hashim
6- Let's Speak Arabic, S. A. Rahman
7- A Practical Approach to the Arabic language, Dr. Wali Akhter

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Skill Enhancement Courses for Five-Year Integrated Masters Programme (FYIMP) in Botany

SEMESTER-3				
Course Type	**Course Code**	**Course Title**	**Credit: 02**	
			Theory	**Practical**
Skill Enhancement Course	**IXXXSEST0323**	**Seed Technology**	**0**	**2**

COURSE OBJECTIVES: *The course will impart students with knowledge of seed biology, seed testing, processing and storage of seeds*

LEARNING OUTCOME: *The students will learn different techniques utilized in testing, processing and storage of seeds. This knowledge can be utilized in day to day life and in entrepreneurship endeavours in this sector.*

COURSE CONTENT:

- **Background information of Seed biology, Processing and storage:** Seed development; National seed testing rules and organizations; Seed dormancy and seed harvesting; Seed Certification.
- Study the morphology and structure of different types of seeds (Dicot and Monocot).
- Study the seed germination using different methods and also calculate the MGT (Mean Germination Time).
- Study the effects of different chemicals and phyto-hormones on seed germination.
- Study the principles, procedure and observation of seed viability by Tetrazolium Test.
- Determination of seed moisture using Air-Oven method and Grinding method.
- Study the seed vigour using different direct vigour tests (Brick Gravel test, paper piercing test, accelerated aging test).
- Demonstration of different methods of seed storage.

Suggested Readings:

- Bhojwani SS & Bhatnagar SP. 1999. *The embryology of Angiosperm.*Vikas publications.
- Copeland LO & McDonald MB.2001. *Principles of seed science and Technology. 4th Ed.* Chapman & Hall.
- Agarwal RL. 1997. *Seed Technology. 2nd Ed.* Oxford & IBH.
- Kelly AF. 1998. *Seed Production of Agricultural Crops.* Longman.
- McDonald MB Jr& Copeland Lo. 1997. *Seed Production: Principles and Practices.* Chapman & Hall.

Skill Enhancement Courses for Five-Year Integrated Masters Programme (FYIMP) in Botany

SEMESTER-3				
Course Type	**Course Code**	**Course Title**	**Credit: 02**	
			Theory	**Practical**
Skill Enhancement Course	**IXXXSEMC0323**	**Mushroom Cultivation**	**0**	**2**

COURSE OBJECTIVES: *The course is designed to acquaint the students with mushrooms and their nutritional value. It will also familiarize the students with basic knowledge of mushrooms cultivation.*

LEARNING OUTCOME: *The course will familiarize students about mushrooms, their cultivation and scientific methodology for farming of mushrooms.*

COURSE CONTENT:

- Characteristics and description of different types of mushrooms.
- Nutritional value of mushrooms and mushroom poisoning.
- Infrastructure, equipment and substrates requited in mushroom cultivation, (polythene bags, vessels, inoculation hook, inoculation loop, sieves, culture racks, water sprayer, tray, boilers and driers), mushroom unit or mushroom house.
- Morphological studies of some mushrooms growing in Kashmir.
- Media preparation and sterilization for culturing some local mushrooms of Kashmir.
- Preparation of Potato dextrose Agar (PDA) and Sawdust spawn substrate.
- Preparation of different types of compost and some compost formulations.
- Preparation of different types of spawns
- Cultivation procedures for Button mushroom
- Picking and handling of Mushrooms

Suggested Readings:

- Fletcher, J. T., and Gaze. R. H. 2007. Mushroom pest and disease control: a color handbook, Elsevier.
- Lynch, T. 2018. Mushroom Cultivation: An Illustrated Guide to Growing Your Own Mushrooms at Home. Quarry Books.
- Stamets, P. 2000. Growing Gourmet and Medicinal Mushrooms. Ten Speed Press
- Stamets, P. 2011. Growing gourmet and medicinal mushrooms. Ten speed press.
- Suman, B. C., Sharma V.P. 2007. Mushroom Cultivation in India. Daya Publishing House.
- Tradd. C. 2014. Organic mushroom farming and myco-remediation: Simple to advanced and experimental techniques for indoor and outdoor cultivation, Chelsea Green Publishing.