Appendix-66
Resolution No. 14-1 (14-1-12)

INDEX

LIST OF SKILL ENHANCEMENT COURSES

Plant Tissue Culture

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Plant Tissue Culture	**2**	**NIL**	**NIL**	**2**	**Class XII**	**NIL**

Learning Objectives

The learning objectives of this course are as follows:

- To discuss the principle of Plant Tissue Culture
- To understand the importance of Plant Tissue Culture and its applications
- To impart hands-on training on various aspects of Tissue Culture
- To understand the importance of aseptic culturing techniques
- To equip the learner to effectively utilize the techniques in various areas like basic research, genetic transformation studies, secondary metabolite production, pharmaceuticals etc

Learning Outcomes

By the end of this course, students will

- Get familiarized with aseptic culture techniques
- Be able to prepare stock solutions and media for experimental purposes
- Comprehend different modes of regeneration
- Have understood the micro propagation mechanism and its intricacies.
- Be able to establish a regeneration protocol using different explant material
- Students will be able to appreciate the applications of plant tissue culture in various domains.
- An industrial visit will give them the required exposure for their holistic understanding of the commercial applications and entrepreneurship avenues in this field of plant tissue culture

Skill development and job opportunities

After completion of this course students may be engaged in following opportunities:

- Entrepreneurship development: Students can start their own Tissue culture set-up
- Tissue culture industry: Individuals can work as researchers, technicians and support staff at tissue culture based industries
- Academia: Individuals can pursue higher education and research opportunities in the field of tissue culture and genetic transformation in universities and research institutions.

SYLLABUS 60 hours

Unit 1: Introduction to Plant tissue Culture 8 hours

Introduction to Plant Tissue culture, Terms and definitions, Historical background, laboratory organization: Design and layout for wash area, media preparation, methods of sterilization, transfer area for aseptic manipulations, Culture rooms, and observation/data collection areas.

Practical:

1. Familiarization with the tissue culture laboratory set-up
2. Familiarization with basic equipment in tissue culture techniques- Autoclave, Laminar Air Flow
3. To understand history, theory and principles of plant tissue culture and concept of cellular totipotency.

Unit 2: Tissue Culture Media 12 hours

Introduction, Types of Media and its importance; Preparation of stock solutions of macronutrients, micronutrients, PGRs and vitamins. pH and buffers- their significance in media. Plant Growth Regulators: Role of PGRs (auxins, cytokinins, abscissic acid, ethylene and Gibberellins) in plant development

Practical:

4. Preparation of stock solutions- Macronutrients, Micronutrients and PGRs
5. Preparation of Murashige and Skoogs medium

Unit 3: Aseptic Techniques 12 hours

Methods of sterilization of equipment's, culture media and explants:-Washing and preparation of glassware's, packing and sterilization, media sterilization, surface sterilization. Precautions to maintain aseptic conditions.

Practical:

6. Study of methods of sterilization A) Moist heat sterilization B) Dry heat sterilization C) Filter sterilization
7. Sterilization of MS medium
8. Surface sterilization of Explant Material

Unit 4: Initiation of Cultures 12 hours

Callus Induction and growth parameters, Callus subculture and maintenance, growth measurements, morphogenesis in callus culture – organogenesis, somatic embryogenesis

Practical:

9. Establishment of callus cultures
10. Establishment of suspension cultures from callus
11. Characterization and sub-culturing of Callus cultures

Unit 5: Micropopagation 12 hours

Micropropagation – stages, advantages, applications, Somatic embryogenesis-induction, factors, comparison with zygotic embryogenesis.

Practical:

12. Establishment of cultures using shoot tip and nodal explants (axillary proliferation)
13. Visit to a Tissue Culture Set-up/ Industry

Unit 6: *Agrobacterium*-mediated genetic transformation **4 hours**

Agrobacterium-the natural plant genetic engineer, understanding the Ti plasmid, selection of recombinants by selectable marker and reporter genes (GUS, luciferase, GFP). Applications.

Recommended Books:

1. Bhojwani, S. S., & Razdan, M. K. (1986). *Plant tissue culture: theory and practice*. Elsevier.
2. Razdan, M. K. (2002). *Introduction To Plant Tissue Culture, 2/E*. Oxford and IBH publishing.
3. Gamborg, O., & Phillips, G. C. (Eds.). (2013). *Plant cell, tissue and organ culture: fundamental methods*. Springer Science & Business Media.
4. Taji, A., Dodd, W. A., & Williams, R. R. (1992). *Plant tissue culture practice*. University of New England.
5. Smith, R. H. (2012). Plant tissue culture: techniques and experiments. Academic press.

Examination scheme and mode:

Evaluation scheme and mode will be as per the guidelines notified by the University of Delhi.

Applications of Plant Tissue Culture

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Applications of Plant Tissue Culture	**2**	**NIL**	**NIL**	**2**	**Class XII**	**NIL**

Learning Objectives

The learning objectives of this course are as follows:

- To discuss the principle of Plant Tissue Culture
- To understand the importance of Plant Tissue Culture and its applications
- To impart hands-on training on various aspects of Tissue Culture
- To understand the importance of aseptic culturing techniques
- To equip the learner to effectively utilize the techniques in various areas like basic research, genetic transformation studies, secondary metabolite production, pharmaceuticals etc

Learning Outcomes

By the end of this course, students will

- Get familiarized with aseptic culture techniques
- Be able to prepare stock solutions and media for experimental purposes
- Have understood the micro propagation mechanism and its intricacies.
- Be able to establish a regeneration protocol using different explant material
- Students will be able to appreciate the applications of plant tissue culture in various domains.
- Able to do mass propagation of true to type and disease free, quality medicinal plants/ornamental plants,/fruit and forest trees through tissue culture

Skill development and job opportunities

After completion of this course students may be engaged in following opportunities:

- Entrepreneurship development: Students can start their own Tissue culture set-up and do mass propagation of true to type and disease free, quality medicinal plants/ornamental plants,/fruit and forest trees through tissue culture
- Tissue culture industry: Individuals can work as researchers, technicians and support staff at tissue culture based industries
- Academia: Individuals can pursue higher education and research opportunities in the field of tissue culture and genetic transformation in universities and research institutions.

SYLLABUS 60 hours

Micropropagation of medicinally/economically important plants **32 hours**

1. Preparation of stock solutions of macronutrients, micronutrients, vitamins, PGRs
2. Preparation of MS medium fortified with the appropriate PGR for explant culture
3. Preparation of the explant material (shoot tips/nodal segments/leaf discs etc.) - excising the material and surface sterilization
4. Culturing of the explant on MS medium
5. Sub-culturing on maintenance medium / rooting medium
6. Acclimatization of the micropropagated plantlets
7. Transfer of plantlets to pots

Anther Culture for production of Adrogenic haploids **28 hours**

8. Identification of unicellular microspore stage of the anther
9. Media Preparation
10. Anther culture (*Datura innoxia)*
11. Complete regeneration of Haploid Plants

Recommended Books:

1. Bhojwani, S. S., & Razdan, M. K. (1986). *Plant tissue culture: theory and practice*. Elsevier.
2. Razdan, M. K. (2002). *Introduction To Plant Tissue Culture, 2/E*. Oxford and IBH publishing.
3. Gamborg, O., & Phillips, G. C. (Eds.). (2013). *Plant cell, tissue and organ culture: fundamental methods*. Springer Science & Business Media.
4. Taji, A., Dodd, W. A., & Williams, R. R. (1992). *Plant tissue culture practice*. University of New England.
5. Smith, R. H. (2012). Plant tissue culture: techniques and experiments. Academic press.

Examination scheme and mode:

Evaluation scheme and mode will be as per the guidelines notified by the University of Delhi.

Exploring Medicinal Plants: From Cultivation to Applications

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Exploring Medicinal Plants: From Cultivation to Applications	**2**	**0**	**0**	**2**	**Class XII**	**NIL**

Learning Objectives:

The learning objectives of this course are as follows:

- To learn various methods of propagating medicinal plants, such as seed germination, stem cuttings, and division.
- To develop the ability to observe and document macroscopic characteristics of herbal materials.
- To learn the microscopic techniques for examination of plant materials.
- To learn the different methods used in extracting bioactive compounds from medicinal plants and the factors to be considered in choosing the appropriate method.
- To conduct phytochemical screening tests to detect the presence of various compounds in medicinal plant extracts.
- To analyze the separated compounds from medicinal plant extracts using Thin Layer Chromatography (TLC).

Learning Outcomes:

By studying this course, students will be able to:

- acquire knowledge of proper care and maintenance of medicinal plants during cultivation.
- learn to identify and describe variations in size, color, odor, and surface texture among different plant specimens.
- acquire the skills to observe and count stomata, the tiny openings on leaf surfaces.
- perform commonly used phytochemical screening methods such as the alkaloid test, glycoside test, steroid and triterpenoid test, tannin test, flavonoid test, and phenol test and interpret the results
- use Thin Layer Chromatography (TLC) to separate compounds from a medicinal plant extract and analyze the separated compounds.
- evaluate the current research and developments in the field of medicinal plants.

PRACTICAL **(60 hours)**

1. Cultivate and monitor medicinal plants to learn propagation techniques.
2. Conduct macroscopic examination of herbal material based on their size, color, odor, and surface texture.
3. Perform microscopic examination to determine stomatal number and index.
4. Conduct microscopic examination to measure the size of calcium oxalate crystals.
5. Determine the moisture content of crude medicinal plant extract.
6. Determine the alcohol-soluble extractive value of medicinal plant extract.
7. Determine the water-soluble extractive value of medicinal plant extract.
8. Perform solvent extraction of bioactive compounds from medicinal plants.
9. Perform phytochemical screening tests for alkaloids, glycosides, tannins, flavonoids, and phenols.
10. Conduct fractionation and purification using chromatographic technique (TLC) to separate compounds from medicinal plant extracts.
11. Visit industries/institutes and prepare a report based on your observations and learning.

Essential/ Recommended Readings:

1. Harborne J. B. (1998) Phytochemical Methods: A guide to modern techniques for plant analysis. Publisher: Champman and Hall.
2. N. Raaman (2006) Phytochemical Techniques. Publisher: New India Publishing Agency. ISBN: 9788189422301, 8189422308.
3. Joseph Sherma, Monika Waksmundzka-Hajnos, Teresa Kowalska (2008) Thin Layer Chromatography in Phytochemistry. Publisher: CRC Press. ISBN: 9781420046786, 1420046780.
4. Alex Gardner (2014) DIY Herbal Gardening. Publisher: CreateSpace Independent Publishing Platform. ISBN: 9781505672473, 1505672473.
5. L. D. Kapoor (2001) Handbook of Ayurvedic Medicinal Plants. Publisher: Taylor & Francis. ISBN: 9780849329296, 0849329299.

6. Raphael and Ikan (2013) "Natural Products: A Laboratory Guide" by Publisher: Academic Press ISBN 978-0123705518.
7. Nava and Dayan (2011) Formulation, Development and Production of Herbal Personal Care Products. Publisher: John Wiley and Sons Inc. ISBN-10: 047048408X.
8. Sanjay Sharma (2015) Current status of herbal product: Regulatory overview. J Pharm Bioallied Sci. 7(4): 293–296. doi: 10.4103/0975-7406.168030
9. WHO (1998) Quality control methods for medicinal plant materials. WHO Library Cataloguing-in-Publication Data. ISBN 978 92 4 150073 9.

Suggestive Reading:

1. Mohar Singh, Nikhil Malhotra (2021) Himalayan Medicinal Plants: Advances in Botany, Production & Research. Publisher: Elsevier Science, ISBN: 9780128234303, 012823430X.
2. H. S. Puri (2003) Rasayana: Ayurvedic Herbs for Longevity and Rejuvenation (Traditional Herbal Medicines for Modern Times Book 2). Publisher: CRC Press. ISBN-13: 978-0415284899.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

DNA barcoding of medicinal/commercially important plants

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
DNA barcoding of medicinal/commercially important plants	**2**	**NIL**	**NIL**	**2**	**Class XII**	**NIL**

Learning Objectives

The Learning Objectives of this course are as follows:

- To give laboratory based first-hand training in various steps involved in DNA barcoding.
- To gain computational laboratory (Bioinformatics) based hands-on-training for DNA barcoding.
- To understand the importance of medicinal/herbal plants in Ayurveda, Unani, Siddha and Homeopathy and other commercially important plants.
- To gather knowledge of the potential adulterants and their harmful effect in medicinal/herbal/commercially important plant formulations as well as herbal trade.
- To gain experience in the management for identifying herbal plant parts vs their potential adulterants.

Learning Outcomes

By the end of the course, the students will be able to:

- Learn DNA barcoding technology.
- Apply DNA barcoding technique in identification of herbal plant/parts and commercially important plant/parts from their potential adulterants.
- Familiarize with the applications of medicinal/herbal plants in Ayurveda, Unani, Siddha and Homeopathy.
- Identify and understand about potential adulterants of medicinal/herbal plant formulations as well as in herbal trade.

Skill development and job opportunities

After completion of this course students may be

- Employed in various herbal plant-based companies.
- Employed in various trade companies related to medicinal/herbal plants.
- Setup a laboratory for DNA barcoding and provide the DNA barcode for herbal plants/ commercially important plants and generate employments.

SYLLABUS 60 hours

Unit 1: Medicinal/Commercially important plant parts and their potential adulterants. 8 hours

Overview of Medicinal/herbal plants and other commercially important plants and their parts, applications of medicinal plants and plant parts such leaves, bark, flower, roots etc. in Ayurveda, Unani, Siddha and Homeopathy. Adulteration in the herbal formulations and herbal trade, applications of DNA barcoding in distinguishing plants/parts/powder from their potential adulterants.

Experiments:

1. Collection of selected medicinally important plant parts/commercially important plant parts and their potential adulterants for DNA isolation.
2. Visit a herbal garden/industry.

Unit 2: DNA barcoding 36 hours

Overview of DNA barcoding, Plant, chloroplast and mitochondrial genomes and genes, structure of nucleic acids, DNA denaturation and renaturation kinetics, melting temperature (Tm) of DNA, primer designing, potential loci for DNA barcoding, DNA sequencing methods.

Experiments:

3. DNA isolation of selected medicinal plant part and other commercially important plant parts and their potential adulterants using CTAB and other methods.
4. Qualitative analysis of isolated DNA using Gel electrophoresis.
5. Qualitative (A^{260}/A^{280}) and quantitative analysis of DNA using *UV-VIS* Spectrophotometer.
6. PCR amplification of loci for plant DNA barcoding using specific primers.
7. Analysis of PCR product by Gel electrophoresis.
8. PCR amplified product sequencing.

Unit 3: Bioinformatics for DNA barcoding 16 hours

Introduction of biological databases, The Barcode of Life Datasystems (BOLD), Medicinal Materials DNA Barcode Database (MMDBD) https://rdccm.cuhk.edu.hk/mherbsdb/, Primer designing tools, The Basic Local Alignment Search Tool (BLAST) and its application in DNA barcoding, Sequence alignment and construction of tree.

Experiments:

9. Biological databases including DNA barcode databases.
10. Primer designing for DNA barcode using primer 3 plus and other tools.
11. Analysis of DNA barcode sequence using The Basic Local Alignment Search Tool (BLAST).
12. Sequence alignment and construction of tree

Recommended Books:

1. W. John Kress and David L. Erickson (2012) DNA Barcodes: Methods and Protocols. Humana Totowa, NJ. https://doi.org/10.1007/978-1-61779-591-6.

2. Subrata Trivedi, Hasibur Rehman, Shalini Saggu, ChellasamyPanneerselvam, Sankar K. Ghosh (2020) DNA Barcoding and Molecular Phylogeny, Springer Nature Switzerland AG 2020, Springer Cham. https://doi.org/10.1007/978-3-030-50075-7
3. Shaheen, Shabnum/ Ramzan, Sehrish/ Khan, Farah/ Ahmad, Mushtaq (2020) Adulteration in Herbal Drugs: A Burning Issue. ISBN 10: 3030280365, ISBN 13: 9783030280369, Publisher: Springer Nature

Examination scheme and mode:

Evaluation scheme and mode will be as per the guidelines notified by the University of Delhi.

Cultivation of Lac: An eco-friendly multiuse wonder product of nature

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Cultivation of Lac: An eco-friendly multiuse wonder product of nature	**2**	**1**	**NIL**	**1**	**Class XII**	**NIL**

Learning Objectives

The Learning Objectives of this course are as follows:

- Understanding the basic principles and concepts of lac cultivation, such as the life cycle of lac insects, methods of propagation, and cultivation techniques.
- Acquiring knowledge of the different species of lac insects, their characteristics, and their ecological requirements.
- Learning about the various methods of harvesting lac, including timing, collection, and processing techniques.
- Developing practical skills in the management of lac plantations, such as pest and disease control, irrigation, and fertilization.
- Understanding the ecological and environmental impacts of lac cultivation and its sustainability.

Learning Outcomes

By the end of the course, the students will be able to:

- understand the basic principles and concepts of lac cultivation, including the life cycle of lac insects, methods of propagation, and cultivation techniques.
- distinguish the different species of lac insects, their characteristics, and their ecological requirements.
- demonstrate proficiency in the methods of harvesting lac, including timing, collection, and processing techniques.
- apply quality control and assurance measures in lac cultivation.
- attain practical skills in the management of lac plantations, such as pest and disease control, irrigation, and fertilization.
- communicate effectively with stakeholders such as farmers, policymakers, and researchers in the field of lac cultivation.
- analyse and evaluate the challenges and opportunities in lac cultivation and proposing innovative solutions.

Skill development and job opportunities

After completion of this course students may be engaged in following job opportunities:

- Entrepreneurship development: Students can start their own entrepreneurship of scientific lac cultivation.
- Lac cultivation and processing industry: Individuals can work in the lac cultivation and processing industry as plantation managers, quality control supervisors, production supervisors, etc.
- NGOs and development agencies: Individuals can work with NGOs and development agencies to promote sustainable lac cultivation practices and provide technical support to small-scale lac farmers.
- Government agencies: Individuals can work with government agencies involved in the promotion and regulation of the lac cultivation industry.
- Academia: Individuals can pursue higher education and research opportunities in the field of lac cultivation in particular and economically important trans-kingdom interactions in general in universities and research institutions.

SYLLABUS

Unit 1: Lac: Composition and their applications **2 hours**

Historical introduction of lac, Types of lac and its composition, industrial applications of lac viz. resin, dye, wax, various chemicals of lac cultivation, Socioeconomic aspects of lac.

Unit 2: Lac production: multiple partners involved and their role **5 hours**

Major and minor lac host pants, Raising major lac host plantations of *Schleichera oleosa*, *Butea monosperma* and *Ziziphus mauritiana*, Selection of suitable host plant, Raising plantations of bushy lac host taxa namely, *Flemingia* sp. and *Calliandra* sp. for intensive lac cultivation, Pruning management of host plants, Integrated nutrient management of host plants. Morphology and lifecycle of lac insect, Crop cycle on host plant, multiparter interactions involving plant host-lac insect- endosymbiont and their role, implications of endosymbionts in lac production.

Practical: **12 hours**

1. How to select suitable lac host plant
2. Scientific pruning techniques of lac host plants
3. Methods and techniques of nutrient management of host plants
4. Study of morphology and life stages of lac insect
5. Crop cycles of lac on different host plants

Unit 3: Pests and diseases in lac ecosystem and their management **1 hours**

Pests and diseases of lac host plants and lac insects; pest management in lac.

Practical: **4 hours**

6. Identification of lac insect pests and diseases
7. Techniques of pest management in lac

Unit 4: Broodlac and inoculation management **2 hours**

Selection, procurement, storing and transport of brood lac, brood Lac Inoculation Methods and inoculation management.

Practical: **4 hours**

8. Methods of determination of brood lac maturity
9. Scientific Brood Lac Inoculation Methods

Unit 5: Scientific lac production methods **4 hours**

Rangini lac production on *Butea monosperma*, Rangini lac production on *Ziziphus mauritiana*, Kusmi lac production on *Schleichera oleosa*, Winter Kusmi lac production on *Ziziphus mauritiana*, Coupe system of lac cultivation, Utilizing multiple lac hosts through coupe system, Intensive lac production on bushy lac host *Flemingia* sp. and *Calliandra* sp., Lac integrated farming system, Alternation of conventional host for sustainable brood lac quality.

Practical: **8 hours**

10. Designing of coupe system of lac cultivation
11. How to formulate lac integrated farming system
    - Students visit to an Institute/Field and Prepare a report.

Unit 6: Harvesting and post-harvest management of lac **1 hours**

Harvesting of lac, harvest management of lac.

Practical: **2 hours**

12. How to harvest lac and harvesting tools
13. Methods of post-harvest management of lac

Recommended Books:

1. Sharma, K.K. & Ramani, R. (Eds.). (2011). *Recent advances in lac culture*. ICAR-IINRG publications.
2. Mathur, P. N., & Lal, S. B. (1993). *Lac Production, Processing and Marketing*. Indian Council of Agricultural Research.
3. Agarwal, J. P., & Gupta, R. K. (2006). *Lac Culture in India*. Daya Publishing House.
4. Agrawal, K. C., & Bhatnagar, S. K. (2009). *Lac Insect and Lac Culture*. Westville Publishing House.
5. Mattu, V. K., & Mathur, P. C. (2005). *Handbook of Lac Production Technology*. Indian Lac Research Institute.
6. Roy, D., & Dasgupta, P. (Eds.). (2016). *Lac Insect (Kerria lacca) Cultivation*, Processing and Uses. CRC Press.

Examination scheme and mode:

Evaluation scheme and mode will be as per the guidelines notified by the University of Delhi.

Lac Characterization and Processing

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Lac Characterization and Processing	**2**	**NIL**	**NIL**	**2**	**Class XII**	**NIL**

Learning Objectives

This course's Learning Objectives are as follows:

- To provide first-hand laboratory training in the various steps involved lac processing.
- To gain laboratory experience in characterization of various types of lac.
- To develop skills in isolating lac wax and lac dye.
- To acquire practical laboratory experience characterising these substances.
- To gain the knowledge of industrial applications lac.
- To give students hands-on experience in the lab isolating a high-value product, aleuritic acid.

Learning Outcomes

By the end of this course, students will

- Be familiar with various steps of lac processing.
- Learn how to characterise different kinds of lac in the lab.
- Be trained in separation of lac wax and lac dye.
- Gain hands-on experience in characterising these compounds in the lab.
- Have real-world laboratory experience in separating a valuable compound (aleuritic acid).

Skill development and job opportunities

Students who successfully complete this course may be qualified for the following positions:

- Students can enhance their entrepreneurial skills by starting their own scientific lac processing unit and lac export unit.
- Quality control supervisors, production supervisors, etc. are only few of the jobs available in the lac processing business.
- Students can collaborate with non-governmental organisations (NGOs) and development agencies (DAs) to disseminate information on sustainable lac farming practises and offer assistance to local lac farmers.

- Employment opportunities exist in government entities that promote and regulate the lac sector.

SYLLABUS

Practical **60 hours**

1. Collection of lac stick from the host plants and scrapping of stick lac
2. Primary processing of stick lac to seed lac
3. Processing of stick lac to seed lac
4. Characterization of the seed lac
5. Processing of seed lac to button lac/ shellac
6. Characterization of button lac /shellac
7. Extraction and purification of lac dye
8. Estimation of lac dye content and its characterization
9. Extraction of lac wax and its characterization
10. Isolation of Aleuritic acid from lac, value added lac product.
11. Project: Applications, Industries, Export and Marketing strategies of lac
12. Industry/ Institute Visit and prepare a report.

Recommended Books:

1. Bangali babu and D.N. Goswami (2010) Processing, chemistry and applications of lac. ICAR publication. ISBN 978-81-7164-065-2.
2. Natural material and products from insects: Chemistry and applications (2020) ed. Dhiraj Kumar and Mohammad Shahid. Springer. ISBN 978-3-030-36610-0
3. Y. Sankaranarayanan (1968) Shellac: Modifications and Compositions. Indian Lac Research Institute, Namkum, Rachi, India.

Examination scheme and mode:

Evaluation scheme and mode will be as per the guidelines notified by the University of Delhi.

SKILL ENHANCEMENT ELECTIVE (SEC) COURSES

Drosophila and Zebrafish model organism in Biological Studies

(CREDITS: PRACTICAL-2)

Course Title & Code	**Credits**	**Credit distribution of the course**			**Eligibility criteria**	**Pre-requisite of the course (if any)**
		Lecture	**Tutorial**	**Practical / Practice**		
Drosophila and Zebrafish model organism in Biological studies	**2**			**2**	12th pass with Biology	NIL

LEARNING OBJECTIVES:

The course will help students to understand the skills required to work with model organisms. To learn the use of model organisms such as Drosophila and Zebrafish in understanding the Biological concepts and processes and its applications in biomedical and Pharma research and industry. The specific objectives of the course are:

- To learn basic requirements for setting up Drosophila and Zebrafish lab.
- To learn to handle, breed and maintain Drosophila and Zebrafish model organism.
- To learn more about biological processes, genetics, drug discovery, toxicology and human diseases using these model organisms.
- To learn to design experiments using these model organisms.

COURSE OUTCOMES

Upon completion of this course students will be skill trained in Drosophila and Zebrafish model system and its applications in Bioscience education, research and Pharmacology and Biotechnology industry.

- Will be able to set up Drosophila and zebrafish lab.
- Will be skilled trained in maintenance of Drosophila stocks and propagation and zebrafish husbandary.

- Have knowledge of designing experiments in genetics, toxicology, behavioural and human disease modelling using these model systems.
- Analyze and interpret the data collected in the laboratory experiments.

Practical (2 credits) **Total 15 weeks**

Total hours: 60

Unit I: Introduction to Drosophila model system (4 weeks)

- Introduction to different model organisms, advantage and disadvantage of using various model organisms, animal ethics.
- Study of life cycle and developmental stages of Drosophila melanogaster
- Male female differentiation
- Study of various mutants
- TLC of eye pigments
- Study of polytene chromosome in Drosophila

Unit II: Mendelian and non Mendelian Genetics (3 weeks)

Drosophila as a model organism to study different principles of genetics

- Collection of virgin fly
- Setting up of crosses in Drosophila
- Scoring of F1 and F2 population, chi-square test

Unit III: Introduction to Zebrafish model system (3 weeks)

Advantages of zebrafish model organism. Basic requirement to set up zebrafish lab. Zebrafish husbandry. Study development stages and developmental phenotypic end points.

- Handling zebrafish, identify male and female zebrafish, and breeding setup.
- To prepare Zebrafish feed and culture Pramecium and Artemia.
- Egg collection and study of developmental stages starting from the zygote - cleavage - blastula - gastrula - segmentation, pharyngula, hatching and early larval development.

Unit IV: Zebrafish as a research and education model (5 weeks)

Importance of zebrafish as a versatile research and education model. Genetic and morphological homology with humans.

- Query based experimental design using zebrafish model system.
- Perform Toxicological assays.
- Perform Behavioral assays.
- Create Human disease models in zebrafish
- Use of transgenic reporter lines.

Essential Reading

- Lakhotia S. C. and Ranganath H. A. (2021) Experiments with Drosophila for Biology Courses, Indian Academy of Sciences, Bengaluru, India, ISBN: 978-81-950664-2-1
- Sunita Joshi, S. and Dhamija, N. (2016) Rediscovering Genetics, IK International, 1st edition, ISBN: 9789384588984
- Westerfield, M. (2000). The Zebrafish book. A guide for laboratory use of Zebrafish (Danio rerio). 4th ed., Univ. of Oregon Press, Eugene. USA
- Mudgal, P., Bhasin, C., Joshi A., Gupta, R. (2021) Zebrafish, a versatile learning tool. Resonance: Journal of science education, 26(11), 1499-1521

Suggested Readings

- Kimmel, C.B., Ballard, W.W., Kimmel, S.R., Ullmann, B. and Schilling, T.F. (1995), Stages of embryonic development of the zebrafish. Dev. Dyn., 203: 253-310. https://doi.org/10.1002/aja.1002030302
- zfin.org

Isolation and characterisation of Plasmid DNA

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Isolation and characterisation of Plasmid DNA	**2**		**NIL**	**2**	**Class XII**	**NIL**

Learning Objectives:

Students of this course should be able to learn:

- Fundamentals of nucleic acid molecules.
- Handling and growing of non-pathogenic bacterial strains of E. coli for recombinant DNA work.
- Basics of Plasmids and its isolation from the culture using different methods.
- Basics of electrophoresis techniques employed for the separation of Nucleic acid molecules.

Learning Outcomes:

At the end of this course, students should be able to learn and perform in Hands-on mode:

- Fundamentals of operation of different types of centrifuges, Electrophoresis, Spectrophotometer and about Good Laboratory Practices and working environment of Genomic Laboratory.
- Use of micropipettes, preparation of solutions, media and sterilisation.
- Basics of different types of nucleic acids
- Handle bacterial strains of E. coli for the isolation of single colony and growth in liquid media.
- Isolate Plasmids using different methods and characterise by agarose gel electrophoresis.

Unit 1: Basic microbiological techniques for culturing and growth of bacteria (16 hours)

Information on general and molecular biology laboratory practices including Biosafety, Information about important strains E. coli used in recombinant DNA work; chemical composition of media used for growing E. coli both on solid surface and in liquid culture.

Practical:

1.1 Pipetting using macro and micro pipettes, macro and micro weighing, measurement of pH, preparation of buffers and other solutions.

1.2 Preparation of solid and liquid media for growing E. coli, sterilization using autoclave and use of Biosafety cabinet.

1.3 Pouring of Petri plates with solid agar media and streaking of E. coli to isolate single colonies.

1.4 Inoculation of E. coli from streaked plate to obtain grown culture.

Unit 2: Isolation of Plasmids and their characterisation (32 hours)

Definition and Features of a plasmid, Comparative description of different plasmids in respect of copy number, compatibility and antibiotics resistance markers, various plasmid isolation methods, Gel electrophoresis for nucleic acids.

Practical:

2.1 Isolation of plasmid DNA using the available culture by alkaline lysis method

2.2 Preparation of agarose gel, electrophoresis and visualization of plasmid DNA on the gel using transilluminator, characterisation of different forms of plasmid DNA.

Unit 3: Isolation and characterization of plasmid DNA by use of column (16 hours)

Technology for isolation of nucleic acids using column, principle of binding and elution of DNA from column. Chromatographic techniques for isolation of nucleic acids.

Practical:

3.1 Isolation of plasmid DNA using the self-grown culture by spin column method.

3.2 Preparation of agarose gel, electrophoresis and visualization of plasmid DNA on the gel, characterisation of different forms of plasmid DNA.

3.3 Documentation of the gel using gel documentation system.

Essential/ Recommended Readings:

1. Sambrook J, Fritsch EF & Maniatis T. Molecular Cloning. A laboratory Manual. 3rd Edition. Cold Spring Harbor Laboratory Press. New York.

Suggestive Reading:

1. Ausubel FM, Brent R, Kingston RE, Moore DD, Seidman JG, Smith JA, Struhl K. Current Protocols in Molecular Biology. (eds.) John Wiley & Sons, Inc. New York.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

Isolation, characterisation and Quality Check of Genomic DNA

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Isolation, characterisation and Quality Check of Genomic DNA	**2**	**NIL**	**NIL**	**2**	**Class XII**	**NIL**

Learning Objectives:

Students of this course should be able to learn:

- Basics of Genomic DNA, need for isolation of genomic DNA and different methods for its isolation.
- Problems due to RNA contamination in further use of genomic DNA and Methods for elimination of contaminating RNA.
- Use of electrophoresis and spectrophotometric techniques for the quantification and quality check of DNA

Learning Outcomes:

At the end of this course, students should be able to learn and perform in Hands-on mode:

- Different methods for isolation of genomic DNA from prokaryotic and eukaryotic cells.
- Handle prokaryotic and eukaryotic cell samples.
- Isolate Genomic DNA and characterise by agarose gel electrophoresis
- Remove RNA contamination from genomic DNA
- Quantify and check quality of DNA by spectrophotometric technique.

Unit 1: Isolation of Genomic DNA from prokaryotic cell (24 hours)

Information on differences between eukaryotic and prokaryotic cells wrt lysis of cells and extraction of DNA, different methods used for isolation of genomic DNA; different kinds of samples as starting material for extraction of DNA.

Practical: Isolation of Genomic DNA

1.1 Composition and preparation of required reagents.

1.2 Isolation of genomic DNA from E. coli culture.

1.3. Gel electrophoresis for isolated genomic DNA

Unit 2: Isolation of Genomic DNA from eukaryotic cell (24 hours)

Different methods used for isolation of genomic DNA; different kinds of samples as starting material for extraction of DNA.

Practical: Isolation of Genomic DNA

2.1 Composition and preparation of required reagents.

2.2 Isolation of genomic DNA from Blood sample etc.

2.3. Gel electrophoresis for isolated genomic DNA

Unit 3: Elimination of RNA contamination followed by quantitation and quality check (16 hours)

Problems due to RNA contamination in further use of genomic DNA in different applications, various methods for removal of RNA from genomic DNA preparation, Gel electrophoresis and UV-visible spectrophotometry-based quantification and quality check of DNA. Other automated systems of quality check for nucleic acids.

Practical Session:

3.1 Removal of RNA from genomic DNA preparation

3.2 Gel electrophoresis of the genomic DNA preparation

3.3 Spectrophotometry-based quantification and quality check of DNA

Essential/ Recommended Readings:

1. Sambrook J, Fritsch EF & Maniatis T. Molecular Cloning. A laboratory Manual. 3rd Edition. Cold Spring Harbor Laboratory Press. New York.
2. Ausubel FM, Brent R, Kingston RE, Moore DD, Seidman JG, Smith JA, Struhl K. Current Protocols in Molecular Biology. (eds.) John Wiley & Sons, Inc. New York.

Suggestive Reading:

1. Alberts, B.,Bray, D, Lewis, J., et al. The Molecular Biology of the Cell. Garland Publishing, New York.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

Polymerase chain reaction (PCR) and its applications

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Polymerase chain reaction (PCR) and its applications	2	NIL	NIL	2	Class XII	NIL

Learning Objectives:

Students of this course should be able to learn:

- Concept of PCR and different types of PCR.
- Principles of oligonucleotide (primer) synthesis and purification
- Designing of Primers for PCR.
- Hands-on setting up of PCR reaction and analysis of the amplified product.
- Purification of PCR product

Learning Outcomes:

At the end of this course, students should be able to learn and perform:

- PCR and its application for research.
- Designing of Primers for PCR and obtaining Primers as synthetic oligonucleotides of
- appropriate quality from commercial sources.
- Designing conditions for setting up a PCR and perform analysis of amplified DNA.
- Purification of PCR-amplified DNA using columns for downstream application.

Unit 1 Concept of PCR and different types of PCR with some applications (12 hours)

Principle of Polymerase Chain reaction and amplification process, use of thermocycler and other equipment required to perform PCR and analysis of amplified DNA, use of synthetic oligonucleotide as primers in PCR.

Practical:

1.1 Demonstration of thermocycler, setting of conditions for a PCR for different types of templates and understanding the reagents used in PCR.

1.2 Chemistry of oligonucleotide synthesis and purification techniques, designing the Primer sequence for PCR through the use of online free software. Handling and storage of Primers for long term use.

Unit 2: PCR reaction for amplification and analysis of the amplified product (32 hours)

Designing and Setting up PCR, understanding about different reaction components, use of different types of polymerases for different length of amplicons, concept of fidelity and processivity of polymerases.

Practical:

2.1 Demonstration of a PCR to explain all the steps required for setting up the reaction and analysis of the amplified product.

2.2 Designing and setting up a PCR individually to amplify a 500 bp product and analysis of the amplified product using agarose gel electrophoresis.

2.3. Designing and setting up a PCR individually to amplify a 1500 bp product and analysis of the amplified product using agarose gel electrophoresis.

Unit 3: Purification of PCR-amplified DNA and downstream applications (20 hours)

Purpose of purification of PCR product, methods for purification, downstream applications of PCR products.

Practical:

3.1 Purification of PCR products by spin column method

3.2 Agarose gel electrophoresis and visualization of the product after purification.

Essential/ Recommended Readings:

1. Sambrook J, Fritsch EF & Maniatis T. Molecular Cloning. A laboratory Manual. 3rd Edition. Cold Spring Harbor Laboratory Press. New York.
2. Ausubel FM, Brent R, Kingston RE, Moore DD, Seidman JG, Smith JA, Struhl K. Current Protocols in Molecular Biology. (eds.) John Wiley & Sons, Inc. New York.

Suggestive Reading:

1. Alberts, B.,Bray, D, Lewis, J., et al. The Molecular Biology of the Cell. Garland Publishing, New York.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

CAD (Computer aided Jewellery Design-I) Coral Draw

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
CAD (Computer aided Jewellery Design-I)	2	0	0	2	Class XII	NIL

Learning Objective:

This course will enable the students to -

- Acquire proficiency in computer application in jewellery designing.
- Introduction about various tools used in coral draw.
- Prepare computer sketches on specified themes.

Learning outcomes

The students will be able to –

- Demonstrate knowledge of technical. Specification using appropriate Coral Draw software
- Competency of modelling & product presentation on this Software.
- Creating Jewellery Designs using this software.
- Develop digital portfolio & show reel.

UNIT 1

Introduction to Corel Draw, Basic Tools in Coral Draw, Various Shapes.

UNIT 2

Drawing & Shaping Objects, Transforming Objects, Corel Draw Effects, Working with Layer, Design Development, Colour Fills and Outlines Tools, Gold Colour Creation.

UNIT 3

Motif Development to Make jewellery, Interactive Blend Tool, Diamond with Measurement, Stone Setting, Creating Shapes & Painting

UNIT 4

Theme Based Designing-Earrings, Bracelets, Pendants, Ring, Brooch, Necklace

UNIT 5

Special Effects to Images-Backgrounds, Text Option, Detail Of jewellery Piece

TEXT BOOKS/WEBSITE

• http://product.corel.com/help/CorelDRAW/540229932/Main/EN/User Guide/CorelDRAWX7.pdf

• http://howto.corel.com/

• http://www.insidegraphics.com/corel_basics/corel_draw_guidelines.asp

• An Introduction to computer aided design for jewellery casting by Lucian Taylor

• Corel Draw 11: the official guide dream tech publishers

CAD (Computer aided Jewellery Design-II) Coral Draw

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
CAD (Computer aided Jewellery Design-II)	2	0	0	2	Class XII	NIL

Learning Objectives:

This course will enable the students to –

- Learn how to convert Manual Design to Digital Form with Exact Measurements using Corel.
- Learn about creating variation and Orthography in this module.
- Additionally, learn how to apply the 3D rendering Effect in Photoshop

Learning Outcomes:

Students will learn the basics of jewellery Design Software "Coral Draw".

• Each section will include a thorough examination of 2D design research conducted with Coral Draw.

• By visiting PCSIR and PGJDC, students will gain knowledge of the CAM manufacturing process.

• Examining various perspectives regarding jewellery, including traditional and contemporary perspectives.

• Learning to create two-dimensional illustrations.

Each endeavor requires research and documentation.

• Submissions: PowerPoint presentation with digital prints.

UNIT 1

Corel Draw, Photoshop, Creating & Editing 3-D Images.

UNIT 2

Introduction to Corel Draw, Drawing & Shaping Objects, Transforming Objects, Corel Draw Effects.

UNIT 3

Working with Layer, Creating Shapes & Painting, Concept of Orthography by Corel.

UNIT 4

Gold Color Creation, Stone Setting.

UNIT 5

Color & Element Variation, 3D Rendering.

TEXT BOOKS/WEBSITE

• http://product.corel.com/help/CorelDRAW/540229932/Main/EN/User Guide/CorelDRAWX7.pdf

• http://howto.corel.com/

• http://www.insidegraphics.com/corel_basics/corel_draw_guidelines.asp

• An Introduction to computer aided design for jewellery casting by Lucian Taylor

• Corel Draw 11: the official guide dream tech publishers

CAD (Computer aided Jewellery Design-III) RHINO

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
CAD (Computer aided Jewellery Design-III) RHINO	2	0	0	2	Class XII	NIL

Learning Objectives:

Students will learn the advance level of tools by learning Jewelry Design Software "RHINO"

• Each content will cover the meticulous research about the 3D design by using Rhino

• Students will learn the process of manufacturing through CAM by visiting PCSIR and PGJDC

• Investigating different perceptions about jewellery including traditional and contemporary

• Learning how to develop 3D perspectives and execution of CAD.

• Research and documentation of each project with the final 3D processing

• The Final outcome in result of CAM.

Learning Outcomes:

At the end students will:

- Understand use of specialist 3D technology and processes in chosen pathway
- Be able to apply understanding of specialist processes to produce design work
- Be able to produce outcomes using specialist 3D technology and processes
- Be able to evaluate own work

UNIT 1

Introduction To Rhino, Surfacing, Stone Setting, Texture

UNIT 2

Text Surfacing, Scooping, Creating Gallery & J-Bag,

UNIT 3

Gold Weight Controlling,

UNIT 4

Creating Human Figure in Rhino

UNIT 5

Converting In to Dye Format, Casting Through CAD-CAM Process.

TEXT BOOKS/WEBSITE

- Rhino for Jewelry Paperback – 2 Jul 2010 by Dana Buscaglia (Author)

CAD (Computer aided Jewellery Design-IV) RHINO

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
CAD (Computer aided Jewellery Design-IV) RHINO	**2**	**0**	**0**	**2**	**Class XII**	**NIL**

Learning Objectives:

Each content will cover the meticulous research about the 3D design by using "RHINO"

• Students will learn the process of manufacturing through CAM by visiting PCSIR and PGJDC

• Investigating different perceptions about jewellery including traditional and contemporary

• Learning how to develop 2D drawings in multiple 3D perspectives and execution of CAD

• Research and documentation of each project with the final 3D processing

• The Final outcome in result of CAM

Learning Outcomes:

At the end students will be:

Able to develop 3D Design with Rendering.

Able to develop exact setting in Design.

Able to Gold Controlling.

Able to Create Master Model & Rubber Dye to Create Different Joints for flexibility.

UNIT 1

Concept Of 3D & 3Design, Concept of Surfacing,

UNIT 2

Stone Setting, Texture Concept, Text Surfacing

UNIT 3

Stone Setting, Texture Concept, Text Surfacing, Concept of Scooping, Concept of Beezal Creating

UNIT 4

Concept of Gold Weight Controlling, Concept of Human Design Creating by Shaper

UNIT 5

Real 3D Rendering, Video Creating, Concept of Converting in Dye Formatting,

Concept Of Casting Through CAD-CAM Process.

TEXT BOOKS

• Cadd3designhelp/Guide/Tutorial

UNDERGRADUATE CURRICULUM FRAMEWORK – 2022

based on

NATIONAL EDUCATION POLICY 2020

B. A. (Hons.) I Music - Hindustani Music (Vocal/Instrumental - Sitar/Sarod/Guitar/Violin/Santoor)

FOUR-YEAR FULL TIME PROGRAMME

SEC Syllabus

Department of Music
Faculty of Music &
Fine Arts University
of Delhi

B.A. (Hons.) I Music - Hindustani Music
Vocal/Instrumental (Sitar/Sarod/Guitar/Violin/Santoor)

Syllabus for SEC Papers

SEMESTER - II

SEC – : HARMONIUM - II

Course Title & Code	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course
		L	T	P		
Study of Harmonium (201)	2	1	0	1	Class XII Pass	Nil

Learning Objectives:

- To throw light on the structure,origin and parts of Harmonium.
- To discuss the notation system
- To understand the different ragas and talas.

Learning Outcomes:

- Students learn the origin and initial form of Harmonium.
- Students are able to demonstrate the various talas and their layakaries.
- Students are able to understand the notation system.

Unit – I (4 weeks)

Study of the origin of Harmonium.

Unit – II (4 weeks)

Study of the structure of the Harmonium.

Unit – III (2 weeks)

Use of Harmonium in various forms of Indian music.

Unit – IV (2 weeks)

Writing notation of compositions in prescribed ragas

Unit V (2 weeks)

Writing notation of Talas with Thah, Dugun, Tigun and Chaugun – Dadra

Unit VI (2 weeks)

Theoretical knowledge of the prescribed ragas

Suggestive readings:

1. Bhartiya Sangeet Ka Itihasa – Dr. Sharad Chandra.Shridhar. Paranjape :- Madhye Pradesh Hindi Granth Acadamy , Bhopal, 2nd Edition: 1985
2. Bhartiye Sangeet Ka Itihasa – Dr. Thakur Jaidev Singh:- Sangeet Research, Kolkatta, Editor: Premlata Sharma, 1st Edition: 1994
3. Sangeet Bodh : Dr. Sharad Chandra Shridhar Paranjape, Madhye Pradesh, Hindi Academy, Bhopal, 1st Edition: 1972
4. Kramik Pustak Malika Part- II , III & IV: - V.N Bhatkhande, Sangeet Karyalaya, Hathras, Jan-2008, Editor: Dr. Laxminarayan Garg
5. Harmonium: Vividh Aayam: Dr. Vinay Kumar Mishra :- Akanksha Publication, New Delhi, 1stEditon: 2015
6. Taal Parichay Part III, Girish Chandra Srivastava, Rubi Prakashan , New Delhi, 2ndEditon: June-2002

SEC – Stage Performance and Viva Voce

Learning Objectives:

- To continue to focus on the basics of playing the Harmonium.
- To encourage the student to attempt to improvise while playing the instrument
- To focus on his learning of newer talas
- To further his training in performance, with other basic ragas as prescribed

Learning Outcomes:

- The basics of the student will get further strengthened
- The student will start to gain self-belief and make attempts to improvise while performing a raga.
- The student will begin to gain some command over increasingly complex talas
- With other basic ragas, the student will understand how to use the flat and sharp notes in ragas with varied tonal phrases
- He will gain confidence of playing with the Tabla

Syllabus:

Prescribed ragas:

1. Bhairav
2. Bhupali
3. Kafi

Unit – I (2 weeks)

Five alankars to be presented in the prescribed ragas.

Unit -II (2 weeks)

One Sargam Geet each in the prescribed ragas

Unit -III (2 weeks)

One Lakshan Geet each in the prescribed ragas

Unit- IV (2 weeks)

Two Drut Khyals with elaborations in any of the prescribed ragas

Unit - V (2 weeks)

Ability to play a Dhun in raga Kafi

Unit - VI (2 weeks)

In-depth knowledge of the prescribed ragas

Unit - VII (2 weeks)

Knowledge and demonstration of the following tala with dugun, tigun and chaugun - Dadra

Unit- VIII (2 weeks)

Basic knowledge of Harmonium and its various parts

Suggestive readings:

- Bhartiya Sangeet Ka Itihasa – Dr. Sharad Chandra.Shridhar. Paranjape :- Madhye Pradesh Hindi Granth Acadamy , Bhopal, 2nd Edition: 1985
- Bhartiye Sangeet Ka Itihasa – Dr. Thakur Jaidev Singh:- Sangeet Research, Kolkatta, Editor: Premlata Sharma, 1st Edition: 1994
- Sangeet Bodh : Dr. Sharad Chandra Shridhar Paranjape, Madhye Pradesh, Hindi Academy, Bhopal, 1st Edition: 1972
- Kramik Pustak Malika Part- II , III & IV: - V.N Bhatkhande, Sangeet Karyalaya, Hathras, Jan-2008, Editor: Dr. Laxminarayan Garg
- Harmonium: Vividh Aayam: Dr. Vinay Kumar Mishra :- Akanksha Publication, New Delhi, 1stEditon: 2015
- Taal Parichay Part III, Girish Chandra Srivastava, Rubi Prakashan , New Delhi, 2nd Edition: June-2002

Department of Sanskrit
UNIVERSITY OF DELHI

UNDERGRADUATE PROGRAMES OF STUDY

SKILL ENHANCMENT COURSES (SEC)

SEMESTER -III

SEC-1: Reading & Writing Skills in Brahmi Scripts

Credit distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Prerequisite of the course
		Lecture	Tutorial	Practical/ Practice		
Reading & Writing Skills in Brahmi Scripts	**02**	**1**		**1**	**Class XII Pass**	**Nil**

Learning Objectives

Course of Epigraphy & script is an inter-disciplinary course within Sanskrit. The Brahmi script used in Indian inscriptions was developed into all modern Indian scripts like Tamil, Malayalam, Oriya, Bangali, Gurmukhi, among others. Study of inscriptions written mostly in Sanskrit languages, helps in preparation of ancient history.

Learning outcomes

This course is helpful for students to investigate how actually Brahmi script developed and transformed into a wide variety at a time when mode and means of transport and communication were extremely slow. After acquiring knowledge of its variation, it will certainly be helpful in ascertaining to understand period of an inscription whose date is uncertain. This course is highly helpful for the students willing to adopt archaeology as their occupation with a background of Sanskrit.

Detailed Syllabus

Unit I
Introduction to Brahmi Script

Introduction to Brahmi Script (Origin and Development)
Early Brahmi alphabet Aśokan period

Unit II
Translation

Translation to variations up to 4th century C.E.
Reading Asokan Inscriptions

Essential/recommended readings

1. Dani, A.H.: Indian Paleography, 1963

2. Upasak, C.S.: History & Paleography of Mauryan Brahmi Script, 1960

3. Verma, T.P.: Paleography of Brahmi script in North India, 1971

4. ओझा, गौ. ही. भारतीय प्राचीन प्रमाला

5. पाण्डेय, राजबली अशोक के आभलेख 1967

Examination scheme and mode: Subject to directions from the Examination Branch/University of Delhi from time to time