

# UNIVERSITY OF DELHI

CNC-II/093/1(26)/2023-24/200

Dated: 21.09.2023

## NOTIFICATION

### Sub: Amendment to Ordinance V

[E.C Resolution No. 14-1/ (14-1-12) and 27-1 (27-1-14) dated 09.06.2023 and 25.08.2023]

Following addition be made to Appendix-II-A to the Ordinance V (2-A) of the Ordinances of the University;

#### **Add the following:**

#### **Skill Enhancement Courses (SECs) Under UGCF-2022**

**Listed under Appendix-II-A to the Ordinance V (2-A) of the Ordinances of the  
University  
(with effect from Academic Year 2022-23)**

A student who pursues any undergraduate programme in the University and its Colleges is offered a pool of Skill Enhancement Courses. A list of such courses as passed by the Executive Council in its meeting dated 09.06.2023 and 25.08.2023 is as below:

- 1) Plant Tissue Culture
- 2) Application of Plant Tissue Culture
- 3) Exploring medicinal plants: from cultivations to applications
- 4) DNA barcoding of medicinal/ commercially important plants
- 5) Cultivation of Lac: an eco-friendly multiuse wonder product of nature
- 6) Lac Characterization and Processing
- 7) Drosophila and Zebrafish model organism in biological studies
- 8) Isolation and characterization of Plasmid DNA
- 9) Isolation, characterization and quality check of Genome DNA
- 10) Polymerase chain reaction (PCR) and its applications
- 11) CAD (Computer aided Jewellery Design-I)
- 12) CAD (Computer aided Jewellery Design-II)
- 13) CAD (Computer aided Jewellery Design-III)
- 14) CAD (Computer aided Jewellery Design-IV)
- 15) Harmonium -II- Study of Harmonium
- 16) Reading & Writing skills in Brahmi Scripts

- 17) Acting Skills in Sanskrit Dramaturgy
- 18) Script writing skills in Sanskrit Dramaturgy
- 19) Fundamentals of Indian Manuscriptology
- 20) Traditional Indian Gastronomy
- 21) E-Learning Tools and Techniques for Sanskrit
- 22) Practices in Horoscopes -I
- 23) Basics of Food Science and Nutrition
- 24) Basic Forensic science
- 25) Basic Laboratory Techniques
- 26) Public health, hygiene and nutrition
- 27) LaTeX Typesetting for Beginners
- 28) Mathematical Modeling with Excel
- 29) Financial Modeling with Excel
- 30) Network Flows
- 31) R-Shiny: Powerful Web Apps for Everyone
- 32) Spoken Persian: Elementary level

# 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		
<b>Plant Tissue Culture</b>	<b>2</b>	<b>NIL</b>	<b>NIL</b>	<b>2</b>	<b>Class XII</b>	<b>NIL</b>

## 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.

**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 Androgenic 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: Chapman 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 ( $T_m$ ) 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		
<b>Cultivation of Lac: An eco-friendly multiuse wonder product of nature</b>	<b>2</b>	<b>1</b>	<b>NIL</b>	<b>1</b>	<b>Class XII</b>	<b>NIL</b>

### 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 plants, 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		
<b>Lac Characterization and Processing</b>	<b>2</b>	<b>NIL</b>	<b>NIL</b>	<b>2</b>	<b>Class XII</b>	<b>NIL</b>

### 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**

- Lakhota 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/UserGuide/CorelDRAWX7.pdf>
- <http://howto.corel.com/>
- [http://www.insidegraphics.com/corel\\_basics/corel\\_draw\\_guidelines.asp](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/UserGuide/CorelDRAWX7.pdf>
- <http://howto.corel.com/>
- [http://www.insidegraphics.com/corel\\_basics/corel\\_draw\\_guidelines.asp](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

**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 Tah, 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 Academy , Bhopal, 2<sup>nd</sup> Edition: 1985
2. Bhartiye Sangeet Ka Itihasa – Dr. Thakur Jaidev Singh:- Sangeet Research, Kolkatta, Editor: Premlata Sharma, 1<sup>st</sup> Edition: 1994
3. Sangeet Bodh : Dr. Sharad Chandra Shridhar Paranjape, Madhye Pradesh, Hindi Academy, Bhopal, 1<sup>st</sup> 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, 1<sup>st</sup> Editon: 2015
6. Taal Parichay Part III, Girish Chandra Srivastava, Rubi Prakashan , New Delhi, 2<sup>nd</sup> Editon: 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, tigon 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, 2<sup>nd</sup> Edition: 1985
- Bhartiye Sangeet Ka Itihasa – Dr. Thakur Jaidev Singh:- Sangeet Research, Kolkatta, Editor: Premlata Sharma, 1<sup>st</sup> Edition: 1994
- Sangeet Bodh : Dr. Sharad Chandra Shridhar Paranjape, Madhye Pradesh, Hindi Academy, Bhopal, 1<sup>st</sup> 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, 1<sup>st</sup> Editon: 2015
- Taal Parichay Part III, Girish Chandra Srivastava, Rubi Prakashan , New Delhi, 2<sup>nd</sup> Edition: June-2002

## 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**

## SEC-2: Acting Skills in Sanskrit Dramaturgy

### 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		
Acting Skills in Sanskrit Dramaturgy	02	1		1	Class XII Pass	Nil

### Learning Objectives

The idea of acting has its connection with the practical aspects of the play related literary works. This paper aims at teaching the fundamental notions that go with the performance of a play on the stage. The practice of performance of drama can further enhance performance's hidden and natural talent. This paper deals with the rules of performance of play (acting) and aims at sharpening the dramatic talent of the students.

### Learning outcomes

After the completion of this course the students will be able to know about the various aspects of performance of the dramatic arts in the Indian context. The course will make the students inspired and encouraged for performing the dramatic arts on the stage.

### Detailed Syllabus

#### Unit I

##### Some Theatrical rules

Competent person for Acting.

Nāṭya-prayoktās-gaṇa (Members of theatrical group) : sūtradhāra nāṭyakāra, naṭa, kuśīlava, bharata, nartaka, vidūṣaka etc.

General and particular rules of assigning the roles.

#### Unit II

##### Types of Abhinaya

Lokadharmī and Nāṭyadharmī Abhinaya.

Types of four Abhinyas with various forms.

Analysis of acting in the context of Abhijñānaśākuntalam

### Essential/recommended readings

1. Ghosh, M.M.: *Nāṭyaśāstra*, Bharata, vol-1, Manisha Granthalaya, Calcutta, 1967.  
Hass, *The Daśarūpaka : A Treatise on Hindu Dramaturgy*, Columbia University, New York, 1912.

2. Adyarangachrya, *Introduction to Bharata's Nāṭyaśāstra*, Popular Prakashan Bombay, 1966.
3. मीरा द्विवेदी, *संस्कृत नाट्य : अभिनय एवं पटकथा लेखन*, परिमल पब्लिकेशन्स, दिल्ली, 2018
4. द्विवेदी, हजारी प्रसाद, *नाट्यशास्त्र की भारतीय परम्परा और दशरूपक*, राजकमल प्रकाशन दिल्ली, 1963.

**Additional Resources:**

1. सीताराम, झा, *नाटक और रंगमंच*, बिहार राष्ट्रभाषा परिषद्, पटना, 1981.
  2. राधावल्लभ, त्रिपाठी, *भारतीय नाट्य: स्वरूप और परंपरा*, हरिसिंह गौर विश्वविद्यालय, सागर, 1988.
  3. वाचस्पति, गैरोला — *भारतीय नाट्यपरम्परा और अभिनयदर्पण*, इलाहाबाद, 1967.
- त्रिपाठी, राधावल्लभ, *भारतीय नाट्यशास्त्र की परम्परा और विश्व रंगमंच*, प्रतिभा प्रकाशन, दिल्ली, 1999.

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

## SEC-3: Script Writing Skills in Sanskrit Dramaturgy

### 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		
Script Writing Skills in Sanskrit Dramaturgy	02	1		1	Class XII Pass	Nil

### Learning Objectives

The script writing forms as essential point in developing a plot into play relates to the practical aspects of theatre skill. It has a close relationship with Acting. This paper aims at acquainting the learners with the basic notions and aspects of the performing art especially of Drama. The practice in composition of drama can enhance one's natural talent. This paper deals with the rules, skills and practices of dramatic composition (script writing) and aims at sharpening the dramatic talent of the students.

### Learning outcomes

After complete this course the students are supposed to be able in developing a plot into a dramatic composition in context to the Indian Dramaturgy. They will learn the skills of constructing a story or an incident into script of a play. The Students will also be inspired and encouraged to prepare the scripts for drama.

### Detailed Syllabus

#### Unit I

#### Some Components of Scripts

##### Development of plot

##### Types of dramatic production:

Sukumāra (Delicate), Āviddha (Energetic)

##### Various kinds of plot (Vastu):.

Dṛśya (presentable) and Sūchya (Restricted scenes)

##### Starting of a play by using Pūrvaraṅga-

Raṅgadvāra, Nāndī, Prastāvanā and Prarocanā.

##### Sources and objectives of play:

Sources : Prakhyat (Historic), Utpaddya (Imaginary), Mishra

Objectives : Dharm, Artha & kaama

##### Steps of developing a Plot :

(i.)Elements for Developing a plot :

- Arthaprakṛtis (caustations),
- Kāryāvasthā (stages of the actions)

- Sandhi (junctures) and Arthopakṣepaka(interludes)- praveshaka etc.

## Unit II

### Dialogues and Three Unities

#### A. Kinds of saṁvāda( Dialogue):

- Sarvaśrāvya or Prakāśa,
- Aśrāvya or Svagata (aside)
- Niyataśrāvya :
  - Janāntika (personal address),
  - Apavārita (confidential),
  - Ākāśabhāṣita (conversation with imaginary person).

#### B. Arrangement of a play by Three Unities :

Time, Actions and place

#### C. Analysis of Script Writing in the context of Abhijñānaśākuntalam

### Essential/recommended readings

1. Ghosh, M.M.: *Nāṭyaśāstra* , Bharata, vol-1, Manisha Granthalaya, Calcutta, 1967.  
Hass, The Daśarūpaka : A Treatise on Hindu Dramaturgy, Columbia University, NewYork , 1912.
2. Adyarangachrya, *Introduction to Bharata's Nāṭyaśāstra*, Popular Prakashan Bombay, 1966.
3. मीरा द्विवेदी , संस्कृत नाट्य : अभिनय एवं पटकथा लेखन, परिमल पब्लिकेशन्स,दिल्ली,2018  
द्विवेदी,हजारी प्रसाद, नाट्यशास्त्र की भारतीय परंपरा और दशरूपक, राजकमल प्रकाशन दिल्ली,1963.

### Additional Resources:

1. सीताराम, झा, नाटक और रंगमंच, बिहार राष्ट्रभाषा परिषद्, पटना, 1981.
2. राधावल्लभ, त्रिपाठी, भारतीय नाट्य: स्वरूप और परंपरा, हरिसिंह गौर विश्वविद्यालय, सागर, 1988.
3. वाचस्पति, गैरोला — भारतीय नाट्यपरम्परा और अभिनयदर्पण, इलाहाबाद, 1967.
4. त्रिपाठी, राधावल्लभ, भारतीय नाट्यशास्त्र की परम्परा और विश्व रंगमंच, प्रतिभा प्रकाशन, दिल्ली,1999.

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

## SEC-4: Fundamentals of Indian Manuscriptology

### 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		
Fundamentals of Indian Manuscriptology	02	1		1	Class XII Pass	Nil

### Learning Objectives

The manuscript repository of India, having more than 10 million codices, is an embodiment of its knowledge tradition. In order to make India a knowledge driven society, it is inevitable that the new generation understand important aspects of manuscripts and by treating and preserving the same may exert to find out and publish hitherto unexplored wisdom lying therein

### Learning outcomes

- (i) This course will enable the students to discern importance of the manuscripts and instant need of curating and editing the same.
- (ii) The student will be able to understand the process of treating the manuscripts of different nature.
- (iii) The student will be aware of the process of preserving the manuscripts for coming generations.

### Detailed Syllabus

#### Unit I

##### Some Components of Scripts

- (i) Importance of manuscripts for unleashing India's greatness.
- (ii) Salient features of Indian manuscriptology.
- (iii) Sources for Indian Manuscripts – different catalogues and Reports.
- (iv) Important manuscript reservoirs in India and abroad and methodology of accessing them

#### Unit II

##### Dialogues and Three Unities

- (i) Dire and Instant need of treating Indian manuscripts.
- (ii) Process of treatment of Indian manuscripts and their preservation.
- (iii) Modes operandi of Mass awareness for preservation of the manuscripts.
- (iv) Basics of critical edition of a text- Identifying various corruptions and their removal.

### Essential/recommended readings

1. Chaubey , B.B. *Manuscriptology: Past and Present* . Poona Orientalia, V01, V, Pg.49

2. Katre, S.M. 1941. *Introduction to Indian textual Criticism*. Bombay : Karnataka Publishing House.
3. लक्ष्मीनरसिंहभट्टः, जा. रामकृष्णः, विरूपाक्ष वि. जड्डीपालः (अनुवादकौ)  
*भारतीयग्रन्थसम्पादनशास्त्रप्रवेशिनी* ( आङ्गलमूलप्रणेता – आचार्य एस. एम. कत्रे ),  
२००२. तिरुपति : राष्ट्रिय संस्कृत विद्यापीठम्.
4. Sankrityayana, Rahula.1938. “Search for Sanskrit MSS. In Tibet.” In *Journal of the Bihar and Orissa Research Society*.Vol.XXIV Part IV. 137-163.
5. सत्येन्द्र. १९७८. *पाण्डुलिपि विज्ञान*. जयपुर : राजस्थान हिन्दी ग्रन्थ अकादमी.
6. Sharma, K.V. 2007. *Manuscriptology of India* in “New Lights on Manuscriptology” Pg.2-4
7. Shasri, P.P.S. 1930. *A Descriptive Catalogue of Sanskrit Manuscripts in the Tanjore Maharaja Sarfoji’s Saraswati Mahal Library*. Shrirangam : Sri Vani Vilas Press.
8. Tripathi, Dipti. 2018. “Reflections on Manuscriptology: Forays into Indian Paradigms of Knowledge managemnet” in *Sambodhi* XLI : 1-10

### **Additional Resources:**

[https://www.jainfoundation.in/JAINLIBRARY/books/sambodhi\\_2018\\_vol\\_41\\_520791\\_hr6.pdf](https://www.jainfoundation.in/JAINLIBRARY/books/sambodhi_2018_vol_41_520791_hr6.pdf)  
<https://www.aanandashram-sanstha.org/>  
<https://www.ssvv.ac.in/about-library>  
<https://www.namami.gov.in/manuscript-resource-centres>  
<http://ignca.gov.in/online-digital-resources/manuscripts/>  
<https://vedabase.io/en/library/sb/11/5/34/>

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

## SEC-5: Traditional Indian Gastronomy (Bhāratīya Pāka Śāstra)

### 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		
Traditional Indian Gastronomy (Bhāratīya Pāka Śāstra)	02	1		1	Class XII Pass	Nil

### Learning Objectives

To train and develop students in Indian Cuisine and Food Culture through Industry Interface and Culinary experts. To strengthen students' Knowledge and skills with instruction based on Indian tradition and culture. The course also aims at enhancing learning menu planning as per festival, quantity preparations and management of resources. To develop competencies to understand Ayurveda and wellness cooking.

### Learning outcomes

Acquire knowledge and skill in Indian culinary practices.

Identify and apply contemporary food safety and sanitation practices along with traditional principles of wellness and Ayurveda.

### Detailed Syllabus

#### Unit I

##### *Pāka Kalā in Sanskrit Sāhitya*

**Pāka Kalā (The art of Indian Cuisine):** Ancient Indian food culture, Characteristics of Indian Cuisine and food commodities, Indian culinary terminology.

**Āhāra in Sanskrit Sāhitya (Food in Sanskrit Literature) :** Food divisions in Sanskrit literature, Food and Drinks in ancient India, diet in Vedic period , food and related art in the Vedic age, food in Sanskrit poetry.

**Swastha Āhāra (Food and Ayurveda) :** Fundamentals of Ayurveda, Identifying the various constituents of Ayurveda and their characteristics, Outline the Three Vital essence (Tridoṣa) of



Ayurveda, Prakriti and Vikriti, Identify the concept about Rasa, Virya, Vipakah and Prabha, Dietary recommendations for Vāta doṣa, Pitta doṣa, Kapha doṣa.

## Unit II

### Āhāra

1. **Prādesika Āhāra (Regional Food):** Cuisines of North India, Cuisines of East India, Cuisines of North India, Cuisines of South India.
2. **Pāka evam Paryāṭana (Travel and Food):** Culinary journey of India, various types of food travel.
3. **Prasād Paramparā (Ritual food tradition):** Tradition of prasād culture in Vaishnav, Shaiva and Shakt sects of Hindu religion.
4. **Pūrva tathā Paścima (Cuisines of East and West):** Specialty cuisines, staple diets, festival and signature dishes of different regions, various cooking methods and techniques used in different regions, preparation, classic recipes.

### Essential/recommended readings

1. *Ayurvedic Science Of Food And Nutrition* by Sanjeev Rastogi , Springer (2014).
2. *Feast and Fasts: A History of Food in India* by Colleen Taylor Sen, (2016).
3. *Aahara : Ancient Secret of Diet in Ayurveda & Yoga* by Dr Pradipkumar R. Suryawanshi (2018).
4. *Indian food: A Historical Companion* by K.T.Achaya, Indian food: A Historical Companion, Oxford University Press, 1998.
5. *Food and Drinks in Ancient India* (Based on Original Sanskrit Sources) by R Mitra, [COSMO PUBLICATIONS, NEW DELHI](#), (2007).
6. *Prasāda, the Gracious Gift, in Contemporary and Classical South Asia* by Andrea Marion Pinkney. Journal of the American Academy of Religion, September 2013, Vol. 81, No. 3, pp. 734–756.
7. *From the God's Kitchen: The Mahāprasād In Shri Jagannāth Temple*, Puri, India, by Sili Rout, SHSS XXIX, NUMBER 1, Summer 2022.
8. *From the Earliest Times to the Sixth Century*, B.C. by Romesh Chunder Dutt, C.I.E.1906. (Chapter 4 – Food and Art in the Vedic age).
9. *Food and Love in Sanskrit Poetry: On the Margin of Desires* by Danielle Feller. Cracow Indological Studies Vol. XXI, No. 2 (2019), pp. 69–124.
10. *पाकशास्त्र*. यशोदा देवी. बनिता हितैषी प्रेस. प्रयागराज, १९१३
11. *पाकशास्त्र*. कान्ति पाण्डेय. बिहार हिन्दी ग्रन्थ अकादमी. २०१३
12. *आहारशास्त्र*. दामोदर वासुदेव. दत्तात्रेय कृष्ण साहू ब्रदर्स, आर्योषधि कारखाना. १८५६.
13. *आहारशास्त्र*. जयनारायण. जीवन दृष्टि प्रकाशन, आरोग्यमन्दिर, यवतमाल-वर्धा.

१९७३

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

## SEC-6: E-Learning Tools and Techniques for Sanskrit

### 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		
E-Learning Tools and Techniques for Sanskrit	02	1		1		Nil

### Learning Objectives

This course will introduce the current research and development in Sanskrit computing. Primary emphasis will be on tools and techniques developed under government and private funding and to explore new technologies for Sanskrit. Special focus will be on e-learning and interacting tools, web application for Sanskrit, Unicode Devanagari typing tools and language computing. HTML will be taught for web application.

### Learning outcomes

The course-level learning outcomes that a student of this course is required to demonstrate are indicated below:

- Learn the basic Interactive Sanskrit Teaching Learning Tools.
- Learn the Basics of Multimedia, Web based tools development.
- Working knowledge of HTML and web page development.
- Working with Unicode Typing in Devanagari Scripts.
- Learn the Various Typing Tools and Software for Devanagari Unicode.
- Learn the Text preservation techniques and web publishing.

### Detailed Syllabus

#### Unit I

##### Interactive Sanskrit Teaching Learning Tools and Typing Tools:

Basics of Multimedia, Web based tools development.

Basics of HTML and web technology

Standard for Indian Languages (Unicode)

Unicode Typing in Devanagari Scripts, Various Typing Tools and Software for Devanagari Script: Baraha, Google Input Tools, Google Assistant

#### Unit II

##### Survey of Various developed Computational Tools for Sanskrit:

Sanskrit Grammar Tools

Sanskrit Text Preservation and Search

Online Indexing Tools for Sanskrit Texts

**Essential/recommended readings**

1. Bharti A., R. Sangal, V. Chaitanya, “NL, Complexity Theory and Logic” in Foundations of Software Technology and Theoretical Computer Science, Springer, 1990.
2. E-Content suggested by Teacher
3. Tools developed by Computational Linguistics Group, Department of Sanskrit, University of Delhi, Delhi-110007 available at: <http://sanskrit.du.ac.in>
4. Basic concept and issues of multimedia:  
<http://www.newagepublishers.com/samplechapter/001697.pdf>
5. Content creation and E-learning in Indian languages: a model:  
[http://eprints.rclis.org/7189/1/vijayakumarjk\\_01.pdf](http://eprints.rclis.org/7189/1/vijayakumarjk_01.pdf)
6. HTML Tutorial - W3Schools: [www.w3schools.com/html](http://www.w3schools.com/html)
7. The Unicode Consortium: <http://unicode.org>
8. [http://baraha.com/v10/help/Keyboards/kan\\_phonetic.htm](http://baraha.com/v10/help/Keyboards/kan_phonetic.htm)
9. <https://www.google.co.in/inputtools/try/>

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

## SEC-7: Practices in Horoscope-I

### 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		
Practices in Horoscope-I	02	1		1		Nil

### Learning Objectives

The objective of this paper is to teach the students about basic principles for horoscope and develop the ability/skill for making Horoscope.

### Learning outcomes

After studying this course students:

Will be able to know the concept behind Panchanga.

Will be able to know the concept of Horoscope.

Will be able to get Knowledge about how to make a horoscope.

### Detailed Syllabus

#### Unit I

सौरपरिवार का सामान्य परिचय,काल के भेद, पञ्चाङ्ग परिचय,द्वादशभाव परिचय |  
ग्रहों का स्वरूप, ग्रहों की उच्च-नीच एवं मूलत्रिकोण राशियाँ, ग्रहदृष्टिविचार |  
ग्रहमैत्री विचार, चर एवं स्थिरकारक ग्रह, राशियों के गुणधर्म एवं स्वामी |

#### Unit II

समयज्ञान, मानक, स्थानीय सूर्योदय, सूर्यास्त, दिनमान  
इष्टकाल, चालन, भयात्-भभोग साधन, स्पष्टग्रहसाधन, चन्द्र स्पष्टीकरण  
अयनांश साधन, पलभा ज्ञान, चर-खण्ड ज्ञान, लंकोदयमान, स्वोदयमान  
लग्नसाधन, ससन्धिद्वादशभावसाधन

### Essential/recommended readings

1. भारतीयकुण्डलीविज्ञानम् – मीठालालहिम्मतराम ओझा, देवर्षिप्रकाशन, वाराणसी ।
2. भारतीयज्योतिषम् - शिवनाथझारखण्डी, उत्तरप्रदेशहिन्दीसंस्थान, लखनऊ, 2010
3. भारतीयज्योतिषम् – नेमिचंद्र शास्त्री, भारतीय ज्ञानपीठ प्रकाशन, दिल्ली, 1992

4. ज्योतिष सर्वस्व- सुरेश चन्द्र मिश्र, रंजन पब्लिकेशन, दिल्ली, 2022
5. भारतीय ज्योतिष का इतिहास-गोरखप्रसाद, उत्तरप्रदेशहिन्दीसंस्थान, लखनऊ, 2010

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

## SEC- : Basics of Food Science and Nutrition

### 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		
Basics of Food Science and Nutrition	2			2	XII <sup>th</sup> pass	NIL

#### Learning Objectives

1. The primary objective of this course is to provide an understanding to the students of the types and biological importance of macro and micronutrients found in the dietary sources.
2. The students will get an opportunity to understand the integrated learning between the areas of Food science and Nutrition.
3. The course will also provide hands-on experience of different methods used to estimate different types of nutrients that will help the students learn the concept nutrition and health.

#### Learning Outcomes

Learners will be able to:

1. Analyse and evaluate concepts in human nutrition and its relation with food and health
2. Understand the concept of food exchange and meal planning
3. Understand the essentiality of macro and micronutrients in food items
4. Assess the quality and nutritive value of food.

#### Skill development and job opportunities:

Students will be able to take up jobs in public and community health schemes where food assessment is done. They can also serve as assistants in programs where meal planning is done like home care facilities, schools, hostels, old age homes. It will provide them the training to apply for jobs in any business establishments concerning food processing, packaging and production. After completion of the entire series, students will be able to take up job opportunities in any business involved with advanced food processing. They would also be eligible to get placements in food and drug assessment centres. The course will also enable students to apply to advanced food science and tech courses.

## **SYLLABUS OF SEC- :**

### **Unit I**

**4 weeks**

**Introduction to nutrition and food science:** Defining nutrition, nutrients and role of nutrients. Food groups- Grouping of foods based on composition. Classification of nutrients: Macronutrients and Micronutrients. Food Energy and the concept of Energy Balance. Principles of meal planning, food exchanges and Balanced diet.

#### **Practical Exercises:**

- Determination of calorie content and nutritive value of different food items.
- Estimation of Total moisture and ash content in the food items.
- Meal planning for healthy individuals depending on adult men and women.

### **Unit II: Macronutrients in food**

**5 weeks**

**Introduction to Dietary Carbohydrates, Proteins and Fats and their roles in body functions, dietary sources and RDA**

#### **Practical Exercises:**

- Estimation of Total Carbohydrate content in food by Molisch's test, Hanes method or Folin and Wu
- Estimation of Total lipid content in food by Soxhlet extraction or Bligh and Dyer method
- Estimation of Total protein content in food by modified Lowry's method.

### **Unit III: Micronutrients**

**6 weeks**

**Introduction to water- and fat-soluble vitamins, brief overview of functions, dietary sources and RDA. Introduction to minerals, brief overview of functions, dietary sources and RDA**

#### **Practical Exercises:**

- Quantitative estimation of Vitamin C in foods by titration
- Quantitative estimation of Vitamin A/E in oils by spectrophotometric methods
- Quantitative of Estimation of mineral content in food. (Ca, P/ Na/K and Fe)

### **Essential Reading**

- Plummer, D. T. (1998) *An Introduction to Practical Biochemistry* (3rd ed.), Tata McGraw Hill Education Pvt. Ltd. (New Delhi); ISBN: 13: 978-0-07-099487-4 / ISBN:10: 0-07-099487-0.
- Cooper, T. G. (2011) *The Tools of Biochemistry* (2nd ed.), Wiley-Interscience Publication (New Delhi); ISBN: 13:9788126530168.
- Raymond, J. L., & Morrow, K. (2020). *Krause's food & the nutrition care process* (15th ed.). Saunders.

- Vasudevan, D. M., & Das, K. S. (2020). *Practical textbook of biochemistry for medical students* (3rd ed.). Jaypee Brothers Medical.
- Manay, N. S. O. (2001). *Food: facts and principles*. New Age International.

### **Suggested Readings**

- Practical Biochemistry, Damodaran Geetha K, Jaypee Brothers Medical Publishers Private Limited; 1st edition (1 January 2011), ISBN: 9789350251416
- Mahan, L. K., & Raymond, J. L. (2016). *Krause's food & the nutrition care process*. Elsevier Health Sciences.
- Malik, D., Narayanasamy, N., Vavilala, P., Takur, J., Sinha, N., (2022). *Textbook of Nutritional Biochemistry*. Springer Singapore, ISBN978-981-19-4149-8.

### **Examination scheme and mode:**

Total Marks: 50

Internal Assessment (Practical): 25 marks

End Semester Practical Exam\*: 25 marks

The Internal Assessment for the course may include Class participation, Assignments, Class tests, Projects, Field Work, Presentations, amongst others as decided by the faculty.



**SEC- : Basic Forensic science: crime scene investigation and evidence collection**

**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		
Basic Forensic science	2			2	Class XII	-

**Learning Objectives**

Forensic science is an essential part of the criminal and civil justice system. Forensic scientists collect and analyze evidences from crime scene and elsewhere. The objective of this analysis is to provide data that can assist in criminal or civil investigation, so that prosecution of suspects of the crime is done or an innocent person is cleared off the crime beyond any reasonable doubt. The specific objectives of this course are as follows:

- To provide an understanding of the sanctity of crime scene
- To understand collection and preservation of forensic evidence.

**Learning outcomes**

The Learning Outcomes of this course are as follows:

- Comprehend the developments in the field of forensic sciences; learn to observe a crime scene for identification of relevant evidences and samples for forensic analysis.
- Understand the importance of collection, packaging and preservation of samples to ensure reliability of data generated.

**Skill development and job opportunities**

- After completion of this course students would obtain the training in collection, documentation, and analysis of physical evidences. They will be encouraged to do short internships in police station, forensic laboratories and research institutes.
- The students will also able to take a job in a forensic laboratories or police station even after completing a one-year course as they are able to collection, preservation and documentation of evidence, drawing a crime scene and doing preliminary analysis at crime scene.

## SYLLABUS OF SEC-

### Unit 1: Basic Forensic

1 week

Introduction, need, scope and Significance of forensic science, History, laws and basic principles of forensic science. Branches of forensic science. Organizational set up of forensic science laboratories.

#### Practical Exercise

- Understanding a crime using case studies.

### Unit 2: Crime scene investigation

6 weeks

Definition, Identification, Mapping, and preservation of a crime scene, Classification in a crime scene. Precautions to ensure credibility of a crime scene. Investigative strategies and eye witness report.

#### Practical exercises:

- Drawing a crime scene.
- Drawing and mapping a crime scene of an unusual case (fire, blast, water)
- Case studies in different indoor and outdoor primary and secondary crime scenes
- Documenting and reconstructing a crime scene.
- Virtual exercise / field trip to a crime scene

### Unit 3: Forensic evidences

8 weeks

Definition of a forensic evidence. Classification based on legal and forensic value Understanding chain of custody. Collection, Preservation, Packaging, and Labeling of chemical, physical evidence and biological evidence (blood, semen and other biological fluids, hair, fibers and fabrics, pollen) for forensic investigation.

#### Practical exercises:

- Collection and preservation of a fresh and dried body fluid sample
- Collection of tissues post mortem.
- Collection of a trace evidence like hair, fiber and pollen from crime scene and during autopsy
- Collection and preservation of a soil sample from crime scene and during autopsy
- Collection of a hand or foot print, tyre-print, fingerprint
- Collection and preservation of evidence for chemical/ballistic analysis.

#### Essential/ recommended readings

- James, S.H., Nordby, J.J. & Bell, S. (2014). *Forensic Science: An Introduction to Scientific and Investigative Techniques, Fourth Edition*: Taylor & Francis. ISBN 9781439853832
- Jones, P., & Williams, R.E. (2009). *Crime Scene Processing and Laboratory Workbook First Edition*: CRC Press. ISBN 9780429249976

- Saferstein, R. (2018). *Criminalistics: An Introduction to Forensic Science, Twelfth edition*: Pearson Education. ISBN 10:0134477596, ISBN 13: 9780134477596
- Lee, H., Palmbach, T. & Miller, M. (2001). *Henry Lee's crime scene handbook, First Edition*: Academic Press ISBN 9780080507989
- Parikh, C.K. (2016). *Parikh's textbook of medical jurisprudence, forensic medicine and toxicology: for classrooms and courtrooms, Seventh Edition*: CBS Publishers and Distributors. ISBN 9788123926469

**Note: Learners are advised to use the latest edition of readings.**

**Examination scheme and mode:**

Total Marks: 50

Internal Assessment: 25 marks

Practical Exam (Internal): 25 marks

The Internal Assessment for the course may include Class participation, Assignments, Class tests, Projects, Field Work, Presentations, amongst others as decided by the faculty.

## 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		
Basic Laboratory Techniques	2			2	XII pass	

## Learning Objectives

This course will help students understand skills required for working in Laboratories. To comprehend the standard operating procedures for laboratory chemicals, autoclave and water wash applications. The specific objectives of the course are:

- To be familiar with laboratory safety manual and GLPs and regulatory requirements.
- To learn about use and working of lab instruments such as pH meters, auto clave, laminar flow, microscopes, spectrophotometers, centrifuges and incubators.
- knowledge of preparation and testing of reagent water in the laboratory Learn how to make solutions and buffers
- Learn about microbiological techniques

## Learning outcomes

At the end of the course the students will be

- Trained in best lab practices
- Able to use lab instruments such as pH meters, auto clave, laminar flow, microscopes, spectrophotometers, centrifuges and incubators
- Able to prepare solutions and buffers
- Able to prepare media and grow microbial culture in aseptic conditions

## Job opportunities:

Students trained in lab skills will be employable in research labs, R & D labs in Pharma and Biotechnology industry and Diagnostic labs

## SYLLABUS OF SEC-

### Unit 1 – Laboratory safety and standards

2 weeks

- Precision, accuracy and sensitivity

### Unit 2– Preparation of solutions/ media

2 weeks

- Preparation of solution (w/w, w/v, Molar, Normal, Stock, standard and serial dilutions)
- Preparation of buffer solution, pH scale, pH meter, Henderson-Hasselbalch equation, pK, (acetate/ phosphate buffer)

### Unit 3– Microbial Techniques

6 weeks

Instrumentation (Microscopy, Laminar Hood, autoclave, shaker incubator, BOD incubator hot air oven)

- Sterilization methods
- Types of Microbial media: Microbial growth media: Minimal Media, Defined media, Complex media, Enriched media, Selective media, and Differential media.
- Staining techniques for microbes
- Isolation of pure cultures of bacteria by streaking method.
- Enumeration of colony forming units (CFU) count by spread plate method
- Growth curve of bacteria
- Culture transfer Techniques: Streaking, Serial dilution and Plating methods.
- Phases of bacterial growth

### Unit 4 – Bioinstrumentation for Separation techniques

5 weeks

#### Chromatography

- Separate biomolecules/dyes using paper/thin layer and column chromatography to illustrate the principle and application of chromatography. Calculate the R<sub>f</sub> value of each component.

#### Centrifugation

- Principle of centrifugation, Basics of sedimentation, Sedimentation coefficient, Factors affecting sedimentation.
- Types of centrifuges and rotors. Microfuges
- Separation plasma and blood cells/ cell fractionation

#### Spectroscopy:

- Principle of UV-visible absorption spectrophotometry, Lambert's Law, Beer's Law, Working of a spectrophotometer.
- Determination of absorption maxima ( $\lambda_{\max}$ ).

- Verification of Lambert's and Beer's law

### **Gel Electrophoresis**

- Principle, instrumentation, application and maintenance of horizontal and vertical electrophoresis.
- Separation of protein sample in denaturing condition and calculation of its molecular weight and mobility.
- Demonstration of separation of nucleic acids using agarose gel electrophoresis.

### **Essential/Recommended readings**

- Biochemistry Laboratory: Modern Theory and Techniques, ( 6<sup>th</sup> edition), Boston, Mass: Prentice Hall; ISBN-13:978-0136043027 Boyer, R.F. ( 2012).
- An Introduction to Practical Biochemistry (1998) 3rd ed., Plummer D. T., Tata McGraw Hill Education Pvt. Ltd. (New Delhi), ISBN:13: 978-0-07-099487-4/ ISBN:10: 0-07-099487-0.
- Cappucino, J. and Sherman, N. (2013). Microbiology: A Laboratory Manual. (10th ed.) Pearson Education Limited; ISBN 13: 9780321840226 Additional Resources: 1. Madigan, M.T., Martinko, J.M., Dunlap, P.V. and Clark, D.P. (2010).

### **Examination scheme and mode:**

Total Marks: 50

Internal Assessment: 25

Practical: 25

Exam (Internal): NIL

End Semester University Exam: NO End Term Exam

The Internal Assessment for the course may include Class participation, Assignments, Class tests, Projects, Field Work, Presentations, amongst others as decided by the faculty.

## SEC : Public health, hygiene and nutrition

### 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		
SEC-	2	0	NIL	2	Class XII	NIL

### Learning Objectives

In the post covid scenario, the students have experienced live the various area where public health is of primary importance. The present course attempts to provide an interdisciplinary understanding of public health issues in India. Learning about processes of proper waste disposal and management of water will have great impact on human health as unsafe drinking water and sanitation was the second leading risk responsible for disease burden in India, mainly through diarrhea and other infections. The specific objectives of the course are:

- To provide a basic understanding of the scope of public health issues, particularly related to collection of primary data in the area of public health nutrition, infectious biology and sanitation, social and preventive medicine, and the environmental issues that affect public health.
- To generate a discussion platform that would encourage a healthy inter- and multidisciplinary interaction amongst the students to get a holistic view of public health issues in India.
- A mini research project on any relevant topic related to public health will be taken up after completing the course.
- After completing the course, the students can also apply for some higher-level courses in different areas of public health as the course helps in building a basic understanding on different aspects related to public health

**Eligibility: Being interdisciplinary in its nature and scope, the course will be equally engaging and beneficial for students of all subject streams.**

### Learning Outcomes

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

- get a holistic overview of the inter disciplinary nature of Public health. They will be able to understand and address behavioral, social and cultural factors that impact individual and population health disparities.
- understand public health issues in India particularly related to Malnutrition,

sanitation issues and related burden of infectious disease, and the role of pollution as a public health concern.

- gets hands-on training on preparation of questionnaire and collection of primary and secondary data relevant to public health issues. They will be trained to use epidemiological methods to analyze patterns of disease progression in a population and describe applications and programs that can help address or mitigate the issue.
- To study various factors deteriorating quality of water by collecting samples from various parts of cities. Check TDS, pH, colour, odour, and transparency of water sample.
- Study of probable causes of stress and mental health problems. Design of some remedial strategies to overcome these problems.
- They will also learn to present the relevant data after subjecting it to statistical analysis. They will be able to identify and apply the appropriate statistical method needed to analyze and describe a public health problem.

### Skill development and job opportunities:

Public health professionals are involved in everything from identifying diseases to creating public policy to helping refugees integrate into new communities. Now more than ever most of the world has witnessed first-hand a public health crisis and there will be no shortage or demand for well-trained public health professionals.

- After completion the course, students will be able to have career opportunities that include Medical and Health Services Manager, Biostatistician, Health care consultant, Epidemiologist, Occupational Health and Safety Specialist, Social and Community Service Manager, Health Education Special

## SYLLABUS OF SEC

### Unit I: Introduction to public health and hygiene

**3 weeks**

Significance of public health, and hygiene to prevent spread of diseases (e.g. TB, leprosy, cholera, food poisoning etc.). Introduction to health care and **WASH** (Water, Sanitation and Hygiene)

#### Practical exercises:

1. To study various hygiene practices like personal, menstrual, oral and hand hygiene etc.
2. Field visit for understanding the health programs and hygiene like Asha worker interviews/Sulabh international museum of toilets/Water Treatment Plant (any one)

### Unit II: Public health Biology

**7 weeks**

What is public health nutrition? Application of nutrition concepts to design programs of public health concern, What are communicable diseases?



Understanding the biology, socioeconomic factors and other environmental conditions that influence the transmission and infection by pathogenic (disease-causing) bacteria, viruses, parasites, and fungi.

### **Practical exercises**

Assessment of nutritional status using anthropometric indices like BMI, WHR.

Assessment of Nutritional status by a survey of clinical and non-invasive biochemical parameters.

- To study the following medically important organisms like mosquito, house fly, cockroach and rats as transmission vectors for infectious disease
- Measuring blood pressure and correlating it with lifestyle.
- Case study of a disease (Nutritional, infectious and lifestyle) along with the public health data with analysis and discussion

### **Unit III: Environmental determinants of Public Health**

**5 weeks**

Determinants of Environmental Health: factors that affect environmental health; Occupational environment and health concerns; Understanding effect of air, water and soil Pollution on health.

#### **Practical exercises:**

- To determine the portability of water using, pH, BOD, COD and MPN of the water sample from different sources.
- Collecting secondary data on AQI from different areas and correlate with health indices in that area.
- Field visits to nearby health care center to collect some data on the rate of a particular disease over past few months or years.

#### **Essential/Recommended readings**

1. Aschengrau A, Seage G.R., (2013) Essentials Of Epidemiology In Public Health Jones and Bartlett Publishers, Inc; 3rd edition
2. Bamji MS, Rao NP, Reddy V.(2017).Textbook of human nutrition. (4thed). Delhi: Oxford and IBH Publishing co. (P) Ltd.
3. Environmental Microbiology edited by I.L. Pepper, C.P. Gerba, T.J. Gentry. 3rd edition. Academic Press, USA. 2014.

#### **Suggested readings:**

1. Gibney et al.(2004). Public health nutrition. Hoboken, NJ: Blackwell Publishing
2. N. Okafor. (2011) Environmental Microbiology of Aquatic and Waste Systems by Springer, USA.
3. Waste Water Microbiology by D.H. Bergey. 2nd Edition. Medtech, India. 2019.
4. Park, K. (2017), Preventive and Social Medicine, B.B. Publishers.

5. Engelkirk P.G. and Duben-Engelkirk J. (2015) Burton's Microbiology for the HealthSciences, 10th Edn. Wolters Kluwer Health.
6. Shanmugavel, G. and George, B. Textbook of public health and hygiene. Darshan Publishers, 25-Jan-2021

**Examination scheme and mode:**

Total Marks: 50

Internal Assessment (Practical): 25 marks

End Semester Practical Exam\*: 25 marks

The Internal Assessment for the course may include Class participation, Assignments, Class tests, Projects, Field Work, Presentations, amongst others as decided by the faculty.

For End Semester Practical Exam External to be appointed by the parent Department.

# LaTeX TYPESETTING FOR BEGINNERS

## 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		
LaTeX Typesetting for Beginners	2	0	0	2	Class XII	NIL

**Learning Objectives:** The objective of this course is to introduce:

- LaTeX, a high-quality open-source typesetting software that produces professional prints and PDF files for research articles and books in all subjects, and languages.
- Typesetting in Indian languages using LaTeX by transliteration and ITRANS packages.

**Learning Outcomes:** After completion of the course the learner will be able to:

- Prepare a LaTeX document with title page including contents, references, and index.
- Understand the Indian language transliteration package (ITRANS-processor) for typesetting Sanskrit, Hindi, Punjabi, Malayalam, etc. using LaTeX.

### **UNIT-I: Getting Started with LaTeX (24 hours)**

Installing and using LaTeX for creating a first LaTeX document; Formatting text and understanding LaTeX commands and environments; Designing pages, Creating a book with chapters and table of contents, Creating and customizing lists, Including images, and creating tables with captions.

### **UNIT-II: Cross-References, Index, Bibliography and Large Documents (16 hours)**

Setting labels and references, Hyperlinks; Customizing the table of contents, Generating an index, Creating a bibliography; Writing basic math formulas and equations; Developing large documents by splitting the input and creating front/back matter.

### **UNIT-III: Typesetting in Indian Languages using LaTeX (20 hours)**

Transliteration symbols with illustrative examples of the Indian languages, such as Sanskrit, Hindi (Devanagari), Punjabi, and Malayalam; Creation of the transliterated document for typesetting in Devanagari (for Sanskrit, Hindi, and Marathi), Gurumukhi (for Punjabi), and Rachana (for Malayalam); ITRANS pre-processor package to convert English-encoded text into various Indian language script such as Gujarati, Bengali, Kannada, Tamil, Telugu, etc.

#### **Essential Readings**

1. Kottwitz, Stefan (2021). LaTeX Beginner's Guide (2nd ed.). Packet Publishing Ltd.
2. Nambudiripad, K.B.M. (2014). LaTeX for Beginners. Narosa Publishing House, Delhi.
3. <https://ctan.org/pkg/devanagari>; <https://www.ctan.org/pkg/gurmukhi-singh>
4. <https://ctan.org/tex-archive/language/indian/itrans>

#### **Suggested Reading**

- Lamport, Leslie (1994). LaTeX: A Document Preparation System, User's Guide and Reference Manual (2nd ed.). Pearson Education. Indian Reprint.

**Practical Exercises:** Getting started with free open-source software LaTeX for typesetting documents from chapter 1 of the text book [1]: LaTeX Beginner's Guide (2nd ed.) by Stefan Kottwitz for installing and using LaTeX. Learners are required to:

- Design a LaTeX document by choosing title, author, date, address, page dimensions, margins, adjust line spacing, add footnotes, and orientation.
- Create a document with bulleted lists, numbered lists, and definition lists. Furthermore, modify the document with compact and customized versions of such lists, including spacing adjustments and interrupting and resuming.
- Create tables, adding captions to tables, putting text into columns, spanning columns and rows, using LaTeX packages to auto-fit columns.
- Generate a document by customizing the table of contents, lists of figures and tables, producing an index pointing to relevant information for keywords and phrases.
- Typesetting fine-tune math expressions, align and number equations, and use various math symbols from the amsmath package in LaTeX.
- Generate a list of five books related to your field of interest under an automatically generated title 'Bibliography', using thebibliography command in LaTeX. Illustrate how these references are cited in the body of a document.
- Create a LaTeX file to manage large documents consisting of several LaTeX files by splitting the input, including front and back matter and a separate title page.
- Transliterate these six names: Aryabhata, Arthashastra, Bhaskaracharya, Chanakya, Ganita Bharati, and Shankaracharya, and write them in itemize form using Devanagari package in LaTeX. Also use the verbatim environment to display the LaTeX code.
- Typeset ten words of your choice using ITRANS pre-processor package in LaTeX to convert English-encoded text into any one Indian language script.

### **Teaching Plan (SEC Paper: LaTeX Typesetting for Beginners)**

**Week 1:** Installing and using LaTeX for creating a first LaTeX document. [1]: **Chapter 1.**

**Week 2:** Formatting text and understanding LaTeX commands and environments. [1]: **Chapter 2.**

**Week 3:** Designing pages, Creating a book with chapters and table of contents. [1]: **Chapter 3.**

**Week 4:** Creating and customizing lists. [1]: **Chapter 4.**

**Week 5:** Including images. [1]: **Chapter 5.**

**Week 6:** Creating tables with captions. [1]: **Chapter 6.**

**Week 7:** Setting labels and references, Hyperlinks. [1]: **Chapter 7.**

**Week 8:** Customizing the table of contents, Generating an index, Creating a bibliography. [1]: **Chapter 8.**

**Week 9:** Writing basic math formulas and equations. [1]: **Chapter 9.**

**Week 10:** Developing large documents by splitting the input and creating front/back matter. [1]: **Chapter 11.**

**Weeks 11, and 12:** Transliteration symbols with illustrative examples of the Indian languages, such as Sanskrit, Hindi (Devanagari), Punjabi, and Malayalam. [2]: **Chapter 9;** and **gurmukhi**

**Weeks 13, and 14:** Creation of transliterated document for typesetting in Devanagari (Sanskrit, Hindi and Marathi), Gurumukhi (Punjabi), and Rachana (Malayalam). [2]: **Chapter 10;** [3]: **Devanagari,** and **Gurmukhi.**

**Week 15:** ITRANS pre-processor package to convert English-encoded text into various Indian language script such as Gujarati, Bengali, Kannada, Tamil, Telugu, etc. [4]: **Itrans: Indian languages**

## MATHEMATICAL MODELING WITH EXCEL

### 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		
<b>Mathematical Modeling with Excel</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>Class XII pass with Mathematics</b>	<b>NIL</b>

**Learning Objectives:** The objective of this course is to introduce:

- The importance and significance of assumptions behind a mathematical model.
- The long-term behavior of discrete dynamical systems numerically and graphically.
- Monte Carlo simulations with real-life examples.
- Linear programming, transportation, assignment and traveling salesman problems.

**Learning Outcomes:** After completion of the course the learner will be able to:

- Understand the purpose and process of mathematical modeling.
- Model different scenarios with linear discrete dynamical systems.
- Formulate and solve LP, transportation and assignment problems using Excel Solver.

#### **UNIT-I: Modeling with Proportionality and Geometric Similarity (20 hours)**

Definition, purpose, process, assumptions, and examples of mathematical modeling; Charts in excel using given data, Modeling with proportionality: Population growth, Radioactive decay, and Free-falling object; Fitting straight lines analytically, Geometric similarity, and Linearizable models.

#### **UNIT-II: Discrete-time Models (16 hours)**

Discrete dynamical system concepts and examples; Long-term behavior and equilibria, Discrete logistic equation, Linear predator-prey model, SIR model of epidemics, SIS model.

#### **UNIT-III: Simulations and Linear Optimization (24 hours)**

Monte Carlo simulation: Flipping a coin, Area under a curve, Car dealership contest, and the birthday problem; Formulation of linear programming, transportation and assignment problems and their solutions using Excel Solver tool; Traveling salesman problem.

#### **Essential Reading**

1. Albright, Brian, & Fox, William P. (2020). Mathematical Modeling with Excel (2nd ed.). CRC Press, Taylor & Francis Group.

#### **Suggested Reading**

- Giordano, Frank R., Fox, William P., & Horton, Steven B. (2014). A First Course in Mathematical Modeling (5th ed.). CENGAGE Learning India.

**Practical Exercises:** Practical work to be performed using Excel spreadsheets for the modeling of the following type of problems:

- The data given below measures shoe length (to the nearest quarter of an inch) and height (to the nearest half inch) of ten persons, to determine if there is a relationship between shoe length and height of a person. Graph Height vs. Shoe Length and fit a straight line to the data. How well does this model fit the data?

Shoe Length	9	10	10.5	11	11.5	11.75	12	12.5	12.75	13
Height	62	64	64.5	69	70	73	72	75	74	77

- The table below contains the total length and weight of 10 black bears. Graph weight vs. length, fit different linearizable models to the data, and select the one that best fits the data. Explain.

Length	139	138	139	120.5	149	141	150	166	180	129.5
Weight	110	60	90	60	85	95	85	155	220	105

- The table below contains data on the population of foxes in a forest over a period of several years. Fit a discrete logistic equation to the data. How well does the model fit the data?

$n$	0	1	2	3	4	5	6	7	8	9	10
$a_n$	50	85	110	130	175	200	215	221	228	232	234

- Consider a disease such as the common cold where a person is *not* immune once they are 'healed.' Once healed, a person becomes susceptible again. Such a disease could be modeled with an SIS model. Implement your model in an Excel worksheet to describe the spread of the common cold through a population of 1,000 where initially 4 people have the cold and assuming that the cold lasts an average of 2 weeks (use  $\alpha = 0.00167$ ). What do you observe?
- Random number generation in Excel and then use it to simulate area under a given curve.
- An automobile repair company performs paint-less dent removal from hail damaged cars and trucks. Each vehicle must be processed in both the body assembly shop and the finishing shop. In the body shop it takes 0.5 man-hours to repair a car and 0.5 man-hours to repair a truck. There are 25 body shop man-hours available per day. In the finishing shop it takes 0.4 man-hours to finish a car and 0.6 man-hours to finish a truck. There are 24 finishing man hours available per day. Each car contributes Rs. 20000 to overall profit, and each truck contributes Rs. 22500 to overall profit. Find number of cars & trucks the company can service a day to maximize overall profit, using Solver.

### Teaching Plan (SEC Paper: Mathematical Modeling with Excel)

**Week 1:** Definition, purpose, process, assumptions, and examples of mathematical modeling; [1]:Chapter 1.

**Week 2:** Charts in excel using given data. [1]: Chapter 2 (Sections 2.1, and 2.2).

**Week 3:** Modeling with proportionality: Population growth, Radioactive decay, and Free-falling object. [1]: Chapter 2 (Section 2.3).

**Weeks 4 and 5:** Fitting straight lines analytically, Geometric similarity, and Linearizable models. [1]: Chapter 2 (Sections 2.4 to 2.6).

**Weeks 6, and 7:** Discrete dynamical system concepts and examples; Long-term behavior and equilibria, Discrete logistic equation. [1]: Chapter 4 (Sections 4.1 to 4.3).

**Weeks 8, and 9:** Linear predator-prey model, SIR model of epidemics, and SIS model. [1]: Chapter 4 (Sections 4.4, and 4.6).

**Weeks 10, and 11:** Monte Carlo simulation: Flipping a coin, Area under a curve, Car dealership contest, and the birthday problem. [1]: Chapter 6 (Section 6.2), and Section 6.3 (Example 6.3.2 and Exercise 6.3.4 only).

**Weeks 12 to 14:** Formulation of linear programming, transportation and assignment problems and their solutions using Excel Solver tool. [1]: Chapter 7 (Sections 7.2 to 7.4).

**Week 15:** Traveling salesman problem. [1]: Chapter 8 (Section 8.8).

## FINANCIAL MODELING WITH EXCEL

### 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		
Financial Modeling with Excel	2	0	0	2	Class XII	NIL

**Learning Objectives:** The objective of this course is to:

- Build financial models using Excel functions to solve some real-life financial problems.
- Acquire practical skills and knowledge that are useful for investment banking.

**Learning Outcomes:** After completion of the course the learner will be able to:

- Compute present value and future value of a cashflow or annuity.
- Create loans and amortization tables, and find price, yield, and duration of a bond.
- Draw option payoff diagrams and option strategy diagrams.
- Find option price using Black-Scholes, and binomial models.

#### **UNIT-I: Time Value of Money (28 hours)**

Building good financial models, Interest rates, Future value, Present value, Annuity, Perpetuity, Present value of an annuity, Present value of a perpetuity, Present value of non-annuity cash flows; Net present value (NPV), Internal rate of return (IRR), NPV vs IRR; Loans and amortization tables, Interest-only loan, An equal amortization term loan, Mortgage; Effective interest rates, Cost of a mortgage, Continuous compounding and discounting.

#### **UNIT-II: Bond Pricing and Duration (12 hours)**

Characteristics of bonds, Zero-coupon bond, Bond valuation, Yield to maturity, Yield curve and forward rates; Macaulay duration, Modified duration, and convexity.

#### **UNIT-III: Options, Black-Scholes, and Binomial Models (20 hours)**

Call and put options, Option strategies, Put-call parity, Black-Scholes formulae for prices of call and put options; Binomial option pricing model, and two-period binomial model.

#### **Essential Readings**

1. Benninga, Simon & Mofkadi, Tal (2018). Principles of Finance with Excel (3rd ed.). Oxford University Press, New York.
2. Sengupta, Chandan (2004). Financial Modeling using Excel and VBA. John Wiley.

#### **Suggested Readings**

- Day, Alastair L. (2015). Mastering Financial Mathematics in Microsoft Excel (3rd ed.). Pearson Education Ltd.
- Luenberger, David G. (2014). Investment Science (2nd ed.). Oxford University Press.

**Practical Exercises:** Review of Excel spreadsheets concepts including functions and graphs from [1]: Part Five Excel Skills. Practical work to be performed using Excel spreadsheets for the modeling of the following type of problems:

1. Calculating future value, present value, and present value of an annuity. Use of Excel functions **FV, PV, NPV, and PMT**. [1]: Chapter 2, Exercises 1,3,5, and 7 pages 46-47.
2. Calculating net-present value (NPV) and internal rate of return (IRR). NPV vs IRR. Use of Excel functions **NPV** and **IRR**. [1]: Chapter 3, Exercises 1 to 3 pages 99-100.
3. Creating loan and amortization table. Use of Excel functions **IPMT** and **PPMT**. [1]: Chapter 4, Exercises 1 to 3 pages 132-133.
4. Computing effective annual interest rate (EAIR), using function **IRR**, and **XIRR** (for dates, not evenly spaced). [1]: Chapter 5, Exercises 1, 4, 7, and 9 pages 169-171.
5. Calculating bond price and yield to maturity (YTM) of a bond. Use of Excel functions **PRICE, YIELD, IRR, and XIRR** (for non-periodic cash flows). [2]: Models 2, and 3 pages 276-279.
6. Computing duration, modified duration, and convexity of a bond. Use of Excel functions **DURATION**, and **MDURATION**. [2]: Models 4, and 5 pages 280-284.
7. Computing payoffs of call and put options, and draw profit diagrams in Excel. [1]: Chapter 17, Exercises 1 to 4 pages 572-574.
8. Studying and comparing option strategies: Bear spread, Bull spread, and Butterfly spread, and draw corresponding profit diagrams in Excel. [1]: Chapter 17, Exercises 18, 19, and 21 pages 581-583.
9. Using Black-Scholes formulae to find prices of call and put options. [1]: Chapter 19, Exercises 1 to 4 page 626.
10. Using binomial model to find prices of call and put options, and Excel tree diagram. [1]: Chapter 20, Exercises 3 to 5 page 653.

### **Teaching Plan (SEC Paper: Financial Modeling with Excel)**

**Week 1:** Excel Skills, Building good financial models.

[1]: Review of Excel basics and functions from Chapters 21 to 23, and Chapter 1(Section 1.4).

**Week 2:** Interest rates, Future value. [1]: Chapter 2 (Section 2.1).

**Weeks 3, and 4:** Present value, Annuity, Perpetuity, Present value of an annuity, Present value of a perpetuity, Present value of non-annuity cash flows. [1]: Chapter 2 (Section 2.2).

**Week 5:** Net present value (NPV), Internal rate of return (IRR), NPV vs IRR.[1]: Chapter 3 (3.1 to 3.3).

**Week 6:** Loans and amortization tables, Interest-only loan, An equal amortization term loan, Mortgage. [1]: Chapter 4 (Sections 4.2 to 4.5).

**Week 7:** Effective interest rates, Cost of a mortgage, Continuous compounding and discounting. [1]: Chapter 5 (Sections 5.1, 5.2, and 5.7).

**Weeks 8 to 10:** Characteristics of bonds, Zero-coupon bond, Bond valuation, Yield, Yield curve and forward rates; Macaulay duration, Modified duration, and convexity. [2]: Chapter 10.

**Weeks 11 to 13:** Call and put options, Option strategies, Put-call parity.

[1]: Chapter 17, and Chapter 18 (Section 18.3, and Exercises 4 to 6, page 602).

**Week 14:** Black-Scholes formulae for prices of call and put options. [1]: Chapter 19 (Section 19.1).

**Week 15:** Binomial option pricing model, Two-period binomial model. [1]: Chapter 20 (20.1 to 20.3).



## NETWORK FLOWS

### 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		
<b>Network Flows</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>Class XII</b>	<b>NIL</b>

**Learning Objectives:** The objective of this course is to:

- Introduce the transportation and assignment problems as network models.
- Learn more about network optimization models and describe the characteristics of various network flow problems.
- Understand the critical path method (CPM) designed to assist in the planning, scheduling, and control of projects.

**Learning Outcomes:** After completion of the course the learner will be able to:

- Formulate and solve transportation and assignment problems using Excel.
- Understand the network flow problem of types - shortest-path problem, minimum spanning tree problem, maximum flow, and minimum cost flow problems, and their optimum solutions using Excel spreadsheet.
- Apply the critical path method (CPM) of time-cost trade-offs for project management.

#### **UNIT-I: Transportation and Assignment Problems (20 hours)**

Network representation of the transportation and assignment problems, Formulate transportation and assignment problems, and solve using Excel.

#### **UNIT-II: Network Optimization Models (24 hours)**

Terminology of networks; Formulate and use Excel to solve shortest-path, minimum spanning tree, maximum flow, and minimum cost flow problems; Critical path method (CPM) of time-cost trade-offs using Excel spreadsheet.

#### **UNIT-III: Case Studies (16 hours)**

Shipping wood to market, Project pickings, Money in motion, Steps to success.

#### **Essential Reading**

1. Hillier, Frederick S., & Lieberman, Gerald J. (2021). Introduction to Operations Research, (11th ed.). McGraw-Hill Education.

#### **Suggested Readings**

- Ragsdale, Cliff T. (2022). Spreadsheet Modeling and Decision Analysis: A Practical Introduction to Business Analytics (9<sup>th</sup> ed.). CENGAGE Learning.
- Taha, Hamdy A. (2017). Operations Research: An Introduction (10th ed.). Pearson Education Limited.

**Practical Exercises:** Use Excel spreadsheet to solve transportation, and assignment problems, shortest-path problem, maximum flow problem, minimum cost flow problem, and CPM calculations of following type of exercises from the chapters 9 and 10 of [1].

- 9.1-1, 9.3-1, Case 9.1 (Shipping Wood to Market), and Case 9.3 (Project Pickings).
- 10.3-2, 10.3-6, 10.5-3, 10.6-5, 10.8-1, Case 10.1 (Money in motion), and Case 10.3 (Steps to success).

### **Teaching Plan (SEC Paper: Network Flows)**

**Weeks 1 to 5:** Network representation of the transportation and assignment problems, Formulate transportation and assignment problems, and solve using Excel.

[1]: Chapter 9 (Sections 9.1, and 9.3).

**Weeks 6, and 7:** Terminology of networks, Formulate and use Excel to solve Shortest-path problem.

[1]: Chapter 10 (Sections 10.2, and 10.3).

**Week 8:** The minimum spanning tree problem. [1]: Chapter 10 (Section 10.4).

**Weeks 9, and 10:** Formulate maximum flow, and minimum cost flow problems and solve using Excel.

[1]: Chapter 10 [Sections 10.5, and 10.6 (including special cases fit into the network format of the minimum cost flow problems, pages 388-390)].

**Week 11:** Critical path method (CPM) of time-cost trade-offs using Excel spreadsheet.

[1]: Chapter 10 (Section 10.8).

**Week 12:** Shipping wood to market. [1]: Chapter 9 (Case 9.1).

**Week 13:** Project pickings. [1]: Chapter 9 (**Case 9.3**).

**Week 14:** Money in motion. [1]: Chapter 10 (Case 10.1).

**Week 15:** Steps to success. [1]: Chapter 10 (**Case 10.3**).

## R-SHINY: POWERFUL WEB APPS FOR EVERYONE

### 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		
R-Shiny: Powerful Web Apps for Everyone	2	0	0	2	Class XII	NIL

**Learning Objectives:** The objective of this course is to:

- Build interactive web applications for charts, tables, graphs, and maps using R Shiny.
- Create, develop, and deploy Shiny web applications using reactive components.
- Customize the appearance of Shiny web apps using Shiny in R Markdown.

**Learning Outcomes:** After completion of the course the learner will be able to:

- Understand the fundamentals of Shiny and develop interactive web applications.
- Understand reactive programming concepts and building reactive web applications.
- Learn R Markdown and deploy Shiny apps locally and to the web with flexdashboard.

#### **UNIT-I: Introduction to Shiny and Basic User Interface (UI) components (20 hours)**

What is Shiny? How Shiny works with R; Create Shiny app directory and file, Adding UI controls, and behaviour; Building the UI using the fluidPage(), Input, and Output functions, and deploy Shiny apps locally using server function.

#### **UNIT-II: Reactive Programming in Shiny (20 hours)**

Basic reactivity: The server function and creating reactive outputs using Shiny's render functions, Reactive programming, Reactive graph, and reactive expressions.

#### **UNIT-III: Shiny in R Markdown (20 hours)**

R Markdown: Installation, Basics, Shiny with flexdashboard, Building Shiny documents by adding the option 'runtime: shiny' to the YAML metadata; Deploy Shiny apps to the web, Embedded Shiny apps, and Shiny widgets.

#### **Essential Readings**

1. Wickham, Hadley (2021). Mastering Shiny: Building Interactive Apps, Reports, and Dashboards Powered by R. O'Reilly Media. (<https://mastering-shiny.org/>)
2. <https://shiny.rstudio.com/tutorial/>
3. Xie, Yihui, Allaire, J.J, & Golemund, Garrett (2019). R Markdown: The Definitive Guide. CRC Press, Taylor & Francis Group. (<https://bookdown.org/yihui/rmarkdown/>)

#### **Suggested Reading**

- Granjon, David (2022). Outstanding User Interfaces with Shiny. CRC Press.

**Practical Exercises:** Practice exercises from first three chapters of Hadley's Mastering Shiny.

### **Teaching Plan (SEC Paper: R-Shiny: Powerful Web Apps for Everyone)**

**Weeks 1, and 2:** What is Shiny? How Shiny works with R; Create Shiny app directory and file, Adding UI controls, and behaviour. [1]: Preface, and Chapter 1.

[2]: Welcome to Shiny: **Lesson1**, and **getting started**

**Weeks 3 to 5:** Basic UI: Building the UI using the fluidPage(), Input, and Output functions, and deploy Shiny apps locally using server function. [1]: Chapter 2

[2]: Build a UI and control widgets: **Lesson2**, and **Lesson3**

[2]: **User Interface and server function**

**Weeks 6 to 8:** Basic reactivity: The server function and creating reactive outputs using Shiny's render functions. [1]: Chapter 3 (pages 27-30); [2]: Reactive output: **Lesson4**

[2]: **Reactive Flow**, and **Reactive Elements**

**Weeks 9, and 10:** Reactive programming, Reactive graph, and reactive expressions.

[1]: Chapter 3 (pages 30-35).

[2]: Reactive expressions: **Lesson6**

**Weeks 11, and 12:** R Markdown: Installation, Basics, Shiny with flexdashboard.

[3]: Chapter 1, Chapter 2 (p. 5-8, and section 2.8.2, p. 42-45), Chapter 5 (Section 5.3, p. 131-135).

**Weeks 13 to 15:** Building Shiny documents by adding the option 'runtime: shiny' to the YAML metadata; Deploy Shiny apps to the web, Embedded Shiny apps, and Shiny widgets.

[3]: Chapter 19 (Sections 19.1 to 19.4, pages 283-293); [2]: Share Shiny Apps: **Lesson7**

**COMMON POOL OF SKILL ENHANCEMENT COURSES (SECs) OFFERED BY  
THE DEPARTMENTS in 1<sup>st</sup> SEMESTER**

**(SEC-1): Spoken Persian – Elementary level**

**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
		Lecture	Tutorial	Practical/ Practice		
Spoken Persian: Elementary level	2	2	Nil	Nil	12 <sup>th</sup> Class Pass	Nil

**Learning Objectives**

The Learning Objectives of this course are as follows:

- To enable the students to speak daily usage spoken Persian

**Learning outcomes**

The Learning Outcomes of this course are as follows:

- By learning this course, the students will be able to speak in commonly spoken Persian language
- By learning this course, the students may get a chance to work as a tourist guide.

**SYLLABUS OF SEC-1**

**UNIT – I (3 Weeks)**

- Applied Grammar

**UNIT – II (3 Weeks)**

- Persian conversation techniques

**UNIT – III (2 Weeks)**

- Translation from Persian to English and vice-versa

**Essential/recommended readings**

1. Let's Learn Persian (first half of the book; pp. 1-103) NCPUL, MHRD, New Delhi.

2. Gargesh, R. Goswami, Translation and Interpretation, University of Delhi, Delhi.
3. Kumar, Rajinder, Elementary Persian Grammar, Great Book Contractor, Lal Kuan, Delhi-110006, 2018.
4. English Farsi Phrasebook with useful wordlist, US Department of State, Washington DC.
5. Sufi, Abdul Aziz, Essentials of Persian Translation, Indo-Iran Society, Lal Kuan, Delhi-06, 1999.



**REGISTRAR**