Skill Enhancement Course

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<p align="center">**SKILL ENHANCEMENT ELECTIVE (SEC) COURSES**</p>

<p align="center">**Series: Food Quality Control**</p>

1. **Basic Food Science and Nutrition**

2. Nutritional assessment and health
   (Anthropometry, Biochemical/biophysical methods, Clinical methods, Dietary methods).

3. Food additives and evaluation
   (Flavours, Colourants, supplements, adulterants, emulsifiers etc.)

4. Food Product Development
   (product specification; quality control points; quality assurance sheets; food manufacturing systems; maintaining nutritional and sensory quality during food processing, storage and distribution; shelf life)

5. Food Packaging and Testing
   (food packaging; food labels; food photography; design features; recipe development; sensory evaluation; relevant legislation; principles of marketing and advertising; current trends within food industry; emerging markets and innovation; functional foods; sustainability; provenance)

Skill development and job opportunities after completing the series:

After completion of the entire series, the student will be able to

- would be eligible to get placements in food and drug assessment centres.
- will be able to set-up their own business/enterprise in food processing, food packaging/food production.
- apply for jobs in any business establishments concerning food processing, packaging and production.
- apply to advanced food science and tech courses
- can seek jobs in different domains such as restaurants, catering establishments, hospitals, food processing companies.
- get jobs such as Quality Manager, Nutritional Therapist, Regulatory Affairs Officer, Product/Process Development Scientist

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			2	XIIth 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 as serve as assistants in program 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 student to apply to advance food science and tech courses.

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. Principals 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.

<div align="center">**SKILL ENHANCEMENT ELECTIVE (SEC) COURSES**</div>

<div align="center">**Series: Forensics**</div>

1. **Basic Forensics: crime scene investigation and evidence collection**

2. **Biological Investigation in Forensics**:
   Serology, Anthropology, entomology, Time and cause of death, blood spatter analysis, DNA fingerprinting

3. **Chemical Aspects of Forensic Science**
   Alcohol and illicit liquor, Toxicological analysis, identification of inks, dyes and drugs. Narcotic analysis, Fire/Arson, Explosives, Petroleum adulterants

4. **Advances in Forensics**
   Digital forensics, cybercrime, ballistic analysis, narco-analysis, brain mapping, Facial reconstruction

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.
- They will also be eligible for jobs in Government or non-Government agencies that are involved in legal and criminal investigations.

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.

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 pollenfrom 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.

SKILL ENHANCEMENT ELECTIVE (SEC) COURSES

Series: Laboratory Skill courses in progression

1. **Basic Laboratory technique**
   Lab practices, Buffers, media preparation, microbial techniques, and instrumentation (Microscopes, laminar flow, pH meter, autoclave, Incubators, Chromatography, centrifuge, Spectrophotometer, Gel electrophoresis).

2. **Medical Diagnostics**
   Haematology, Blood Pressure, PFT, Histology, Histochemistry and instrumentation (Spirometer, Microscope, Microtome, Sphygmomanometer).

3. **Clinical Biochemistry**
   Glucose Tolerance Test, HbA1C, Liver function test, Kidney function test, Urine analysis, Lipid profile, Cardio-vascular Disease diagnostic tests. Introduction to Autoanalyzer.

4. **Molecular and Advanced techniques**
   Immuno-techniques, ELISA, FACS, Rapid Antigen test, PCR, RT-PCR, X-Ray, Ultra-sound, Endoscopy, MRI, CT, micro-CT.

5. **Model Systems: Microbial, Plant and Animal**
   E. coli, cell culture, plant tissue culture, *Drosophila*, Zebrafish, *c.elegans*.

Job Opportunities:

Students after completing these series of courses will be well trained to be employed as technical officer/personal in research labs, R & D labs in Pharma and Biotechnology industry involved with drug discovery and vaccine development and Diagnostic labs.

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

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 Rf 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 (λmax).

- 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, (6th edition), Boston, Mass: Prentice Hall; ISBN-13:978-0136043027Boyer, 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.

SKILL ENHANCEMENT ELECTIVE (SEC) COURSES

Series: Public Health

1. **Public health, hygiene and nutrition**

2. Epidemiology: Data Collection to Data Analysis
   (Understanding epidemiology: Collection, generation, and analysis of public health data. Application of statistical tools to analyze and present public health data.)

3. Infectious diseases: Impact on Public health
   (global impact of the HIV/AIDS, malaria, and tuberculosis epidemics; the emergence of previously unrecognized pathogens; and the threat of resistant pathogens)

4. Public health concerns in Non-communicable diseases
   (Hypertension, Coronary Heart diseases, Stroke, Diabetes mellitus, Obesity and Mental –health, BMI calculation)

5. **Health care and Fitness or Health education and behavioral science**
   (Fitness, Nutrition, Public health concerns: Physical activity, Weight management)

Skill development and job opportunities:
After completion of the series in Public Health, the students will be able to:
- take up jobs in public and community health schemes and organizations
- go for internships in Social and preventive medicine in Hospitals, Government local health care centers, NGO's, Government ministries**.**
- The course would also provide a basic training enabling the student to apply to advanced public health courses.

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Creditdistributionofthecourse			Eligibilitycriteria	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.

Skill Enhancement (SEC) Courses Proposed under UGCF2022

(For all Honors, and Multidisciplinary with 3 core and 2 core disciplines)

DEPARTMENT OF MATHEMATICS

S. No.	SEC (0L + 0T + 2P = 2 credits) (2P = 4 hours practical)
1	**LaTeX Typesetting for Beginners**
2	**Mathematical Modeling with Excel**
3	**Financial Modeling with Excel**
4	**Network Flows**
5	**R-Shiny: Powerful Web Apps for Everyone**

1. **LaTeX Typesetting for Beginners**

   This skill enhancement course on LaTeX is meant for absolute beginners, undoubtedly a useful tool for students of all disciplines, with no prerequisite. 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. The special feature of this skill course is LaTeX coding in Indian languages including Devanagari (Sanskrit, Hindi, and Marathi), Gurumukhi (Punjabi) and others using ITRANS pre-processor.

2. **Mathematical Modeling with Excel**

   The main goal of this skill course is to present different ways of building and analyzing real-life mathematical models using Excel spreadsheet tools in a format that can be used by students of all disciplines. Excel is chosen as the only software used to implement and analyze models as it is easy to use and almost everyone is familiar with it, so it takes very little time to become comfortable with the modeling.

3. **Financial Modeling with Excel**

   The practical approach of this course enables students to develop the requisite skills and techniques necessary for success in various financial sectors, including commercial banks, investment banks, hedge funds, and the insurance industry. Students will learn how to utilize appropriate option strategies for both hedging and speculation purposes to tackle real-world financial scenarios, utilizing Excel - a vital tool in the realm of finance.

4. **Network Flows**

   Several practical decision problems in business fall into a category known as *network flow problems*. These problems share a common characteristic—they can be described or displayed in a graphical form known as a **network**. This skill course focuses on several types of network flow problems: transportation/assignment problems, shortest path, minimum spanning tree, maximal flow, and minimum cost flow problems. Although specialized solution procedures exist for solving above network flow problems, we will consider how to formulate, and solve using Excel.

5. **R-Shiny: Powerful Web Apps for Everyone**

   This skill enhancement course is designed to provide a structured approach to acquiring the necessary skills and knowledge to build interactive web applications using R Shiny. With R Shiny, one can turn the R code and data visualizations into interactive dashboards, data exploration tools, predictive models, and more. Shiny provides a versatile platform for bringing ideas to life and making the work accessible to a wider audience through dynamic web applications in R Markdown.

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		
Mathematical Modeling with Excel	2	0	0	2	Class XII pass with Mathematics	NIL

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 α = 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		
Network Flows	2	0	0	2	Class XII	NIL

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 (9th 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, & Grolemund, 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**

GENERIC ELECTIVES (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	12th 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.