FACULTY OF ENGINEERING AND TECHNOLOGY

Syllabus

For

BACHELOR OF VOCATION (B.VOC.)
(DATA SCIENCE)
(Semester: I – IV)

Session: 2019–20

GURU NANAK DEV UNIVERSITY
AMRITSAR

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(ii) Subject to change in the syllabi at any time.  
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## SEMESTER – I:

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<td>Paper – VI</td>
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<td>50</td>
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<tr>
<td></td>
<td><strong>Punjab History &amp; Culture (From Earliest Times to C 320)</strong></td>
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<tr>
<td>Paper – VII</td>
<td>* Drug Abuse: Problem, Management and Prevention</td>
<td>50</td>
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## SEMESTER – II:

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<tr>
<th>Paper No.</th>
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<th>M. Marks</th>
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<tr>
<td>Paper – I</td>
<td>Introduction to Data Science (Theory)</td>
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<td>Paper – VI</td>
<td>Punjabi (Compulsory) / <strong>ਪੰਜਾਬੀ ਪ੍ਰਾਜਾਪਤੀ</strong> /</td>
<td>50</td>
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<td></td>
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</tbody>
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Note: * Marks of this Paper will not be included in the Total Marks.
** (Special Paper in lieu of Punjabi Compulsory)
(For those students who are not domicile of Punjab)
Semester – III:

<table>
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<tr>
<th>Courses</th>
<th>Hours</th>
<th>Marks</th>
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<td>Paper-II Business Economics</td>
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<td>Paper-III Statistical Inference-I</td>
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Semester – IV:

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<th>Courses</th>
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<tr>
<td>Paper-I Basics of Linear Algebra and Numerical Analysis</td>
<td>Theory</td>
<td>3</td>
</tr>
<tr>
<td>Paper-II Statistical Inference-II</td>
<td>Theory</td>
<td>3</td>
</tr>
<tr>
<td>Paper-III Algorithms and Heuristics</td>
<td>Theory</td>
<td>3</td>
</tr>
<tr>
<td>Paper-IV Big Data</td>
<td>Theory</td>
<td>3</td>
</tr>
<tr>
<td>Paper-V Big Data Analytics using R</td>
<td>Practical</td>
<td>3</td>
</tr>
<tr>
<td>Paper-VI Programming Lab based on Numerical Analysis</td>
<td>Practical</td>
<td>3</td>
</tr>
<tr>
<td>Paper-VII * Environmental Studies (ESL-221)</td>
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</tbody>
</table>

* Marks of Paper EVS will not be included in Grand Total.
BACHELOR OF VOCATION (B.VOC.) (DATA SCIENCE)
SEMESTER – I

Paper–I: Descriptive Statistics
(Theory)

Time: 3 Hours  Max. Marks: 75

Instructions for the Paper Setters:-
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A
Definition, Scope, Significance, Limitations. Tabulation, Classification and Graphical representation of data (Pie Chart, Bar Diagram, Histogram, Frequency Polygon, Ogive Curve, etc.).

SECTION-B

SECTION-C
Mathematical and Statistical probability, Elementary events, Sample space, Compound events, Types of events, Mutually exclusive, Independent events, addition law of probability, Conditional probability, Multiplication theorem of probability, Baye’s Theorem.

SECTION-D
Concept of Random Variable, Probability Mass Function & Density Function, Mathematical Expectation (meaning and properties), Moments, Moment Generating Function and Characteristic Function.

Text/References:
BACHELOR OF VOCATION (B.VOC.) (DATA SCIENCE)
SEMESTER – I

Paper–II: Database Management System
(Theory)

Time: 3 Hours Max. Marks: 75

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

SECTION-B
Data Base Systems Concepts and Architecture: Data Models, Schemas and Instances, DBMS architecture and Data Independence, Data base languages & Interfaces, DBMS functions and component modules

SECTION-C


SECTION-D

Text/References:
BACHELOR OF VOCATION (B.VOC.) (DATA SCIENCE)
SEMESTER – I

Paper–III: Data Entry Using MS-Word & MS-Excel
(Practical)

Time: 3 Hours
Max. Marks: 75

Note: Practical exam to be conducted by the external examiner.

SECTION-A
MS-Word: Overview, Creating, Saving, Opening, Importing, Exporting & Inserting files. Formatting pages, paragraphs and sections. Indents and outdates. Creating lists and numbering. Heading Styles, Fonts and size editing,

SECTION-B

SECTION-C
MS-Excel: Worksheet overview. Entering information in Worksheet. Opening and saving workbook. Formatting number and texts, Protecting cells. Producing Charges and printing operations graphs,

SECTION-D
Creating Different Formulas, 3D formulas, Copying and pasting formulas, conditional formatting and cell styles, creating worksheet charts, sharing workbook, tables, sorting data, filtering data, using what-if analysis, table related functions and making macros.

Text/References:

Note: The Latest Editions of the books should be followed
BACHELOR OF VOCATION (B.VOC.) (DATA SCIENCE)
SEMESTER – I

Paper–IV: MS-Access
(Practical)

Time: 3 Hours                      Max. Marks: 75

Note: Practical exam to be conducted by the external examiner.

Practical based on MS-Access

SECTION-A

1. Basics of RDBMS
- Introduction to database -What is a Database
- Why use a Relational Database
- Overview of Database Design
- Integrity Rules (Primary/Foreign Key, One-to-Many, Many-to-Many, One-to-One)
- Introduction to MS Access (Objects, Navigation).

2. Working with Table:
- Create a Table in MS Access
- Data Types
- Field Properties
- validation rules Data Entry
- Add record delete record and edit text
- Sort option
- find/replace
- What is filter
- rearrange columns
- freeze columns
- Edit a Tables- copy, delete, import
- modify table structure

SECTION-B

3. Working with Query:
- Introduction of relationship
- How to Create a Relationship
- Types of Relationship
- how to Create a relationship
- set a rule for Referential Integrity
- change the join type
- delete a relationship
- save relationship
- Queries & Filter –difference between queries and filter
- What is Query
- filter using multiple fields AND, OR
- advance filter Queries
- create Query with one table
- select query
- find duplicate record with query
- find unmatched record with query
- run query
- save and change query
SECTION-C

4. Working with Forms:
   - Introduction to Forms
   - Types of Basic Forms: Columnar, Tabular, Datasheet, Main/Subforms
   - add headers and footers
   - add fields to form
   - Tool Box
     - add text to form
     - use label
     - use option button
     - Use Check box
     - Use Combo box
     - Use List box
   - Create Form by using Wizard

SECTION-D

5. Working with Reports:
   - Introduction to Reports
   - Types of Basic Reports: Single Column, Tabular Report Groups
   - Single and Multi table report
   - Preview and print report
   - Creating Reports and Labels, Wizard

Text/References:

2. Access 2013: Bible by Michael Alexander
Instructions for the Paper Setters:-
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

The syllabus is divided in four sections as mentioned below:

Section–A
Reading Skills: Reading Tactics and strategies; Reading purposes–kinds of purposes and associated comprehension; Reading for direct meanings.

Section–B
Reading for understanding concepts, details, coherence, logical progression and meanings of phrases/expressions.

Activities:
- Comprehension questions in multiple choice format
- Short comprehension questions based on content and development of ideas

Section–C
Writing Skills: Guidelines for effective writing; writing styles for application, personal letter, official/business letter.

Activities:
- Formatting personal and business letters.
- Organising the details in a sequential order

Section–D
Resume, memo, notices etc.; outline and revision.

Activities:
- Converting a biographical note into a sequenced resume or vice-versa
- Ordering and sub-dividing the contents while making notes.
- Writing notices for circulation/boards

Recommended Books:
- *Oxford Guide to Effective Writing and Speaking* by John Seely.
- *English Grammar in Use* (Fourth Edition) by Raymond Murphy, CUP
BACHELOR OF VOCATION (B.VOC.) (DATA SCIENCE)
SEMMETER – I

PAPER-VI: पेना (खुलनी)

पर-वृष्ण अवं प्रम-प्रमाणः

मैमर-थे

आगम भवनम (विद्या वजा).
(भव. सुंदरी सीता भव दलितभाषा भिन्न भाषा)
वहुदू लगभग देश पुस्तकालयो, भारतमात्र।
(भूमि आधार लेखनमात्र, मद्दत)

मैमर-थी

दिविनगमन पान (दिविनगमन शेष-मंजूरित)
मीम. म.म.प्रथम,
पैमानी माधुर खुलना, खुलना। (भव 1 ते 6)
(लिखित द्वारा मद्दत-पेनी)

मैमर-भी

(०) पेना उच्चरण

(अ) पेना पद्ध वे प्रमाण दे हिंदीं देथ।

मैमर-ठी

(०) पैना यीती हिंदी : हिंदी धर्म, हिंदी मामला दे विद्यार्थी, मद्दत, दिखाएल, मुद्द-पुष्प

(अ) भाषा धौलवारीमात्र : भाषा का टवराकी फुट, भाषा अवं हिंद-भाषा का भाषा, पैनारी

मैमर-ठी अवं पन्दितभाषा कठी उपदिः

1. पृष्ठ पृष्ठ वे सक्र धमा त्यथा। यह धमा हिंदीं दे पृष्ठ पृष्ठ साधा।
2. दिखाएलवारी से ढेर पृष्ठ पृष्ठ धमा वकरे उठा। उठ धमा हिंदीं दे पृष्ठ पृष्ठ साधा।
3. पृष्ठ पृष्ठ दे सक्र पंडत उठा।
4. पृष्ठ पृष्ठ वकरे धमा सिद्ध पृष्ठ वकरे उं पृष्ठ पृष्ठ हिंद-भाषा अवरे दस्य दे दस्य धमा

हिंद-पृष्ठ हिंदा लिए वकरे मद्दत दे।
PAPER-VI: भूमि धारणी
(In lieu of Compulsory Punjabi)

विषय: 3 पृष्ठे                      बहु भाषाय: 50

पाठ-भूमि

मैत्रवृत्ति

पैंडी भूमि, भूमि कृषि, पैंड विंदी चाहे लहर अठे रेत रिश्च रेत
काले लहर अठे अघोरा (भूमि नाट-धारा)
सरास्थ (विंदी, विंदी, अफ़ग़ा) : पहाड़ अठे डबड़े

मैत्रवृत्ति-शी

पैंडी माध्य-मध्यज्य : भूमि नाट-धारा
(माध्यम माध्य, मध्यम मध्य, भिन्नता मध्य, भूमि मध्य, भोजन मध्य ज्ये डिझ्यूज़)

मैत्रवृत्ति-मी

हिंदी डबड़े दी पैंडी माध्य-मध्यज्य : घम्य, घम्य, विण्ड्र-राज़, पैंडी अठे रेत विंद्रभ आठि लहर
मध्य-मध्यज्य

मैत्रवृत्ति-शी

उठे दे में हिस्टिंग दे ला, वधु भीमिथिएं दे ला, रूंड़ दे ला, रेत दे मे उठ विंद्रभी मध्य-मध्यज्य

भूमि-रंग अठे पैंडीभण रंगी उपारकिंग

1. पृथल रंगे दे चाँद ज्ञात रेठो। उठ ज्ञात रिचं दे पृथल पृंड़े नरहो।
2. रंगिंथभणी दे बौंड पृथल रंगे उठ। उठ ज्ञात रिचं रिच मृतल समभी दे।
3. उनेज पृथल दे पृथल भें उठ।
4. पेंदू मैंट ज्ञात ज्ञात देखे उं पृथल दी रंग अठो एंदू एंदू चाँ रंग रंग-पृथल
   रिच वत मध्य

10
BACHELOR OF VOCATION (B.VOC.) (DATA SCIENCE)
SEMESTER – I
PAPER–VI: Punjab History & Culture (From Earliest Times to C 320)

(Special Paper in lieu of Punjabi Compulsory)
(For those students who are not domicile of Punjab)

Time: 3 Hours
Max. Marks: 50

Instructions for the Paper Setters:-
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Section–A
1. Physical features of the Punjab and its impact on history.
2. Sources of the ancient history of Punjab

Section–B
3. Harappan Civilization: Town planning; social, economic and religious life of the Indus Valley People.

Section–C
5. Social, Religious and Economic life during Rig Vedic Age.

Section–D
7. Teachings and impact of Buddhism
8. Jainism in the Punjab

Suggested Readings:
Instructions for the Paper Setters:-
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Section – A

Meaning of Drug Abuse:

Section – B

Consequences of Drug Abuse for:
- Family: Violence.
- Society: Crime.
- Nation: Law and Order problem.

Section – C

Management of Drug Abuse:
Medical Management: Medication for treatment and to reduce withdrawal effects.

Section – D

Psychiatric Management: Counselling, Behavioural and Cognitive therapy.
Social Management: Family, Group therapy and Environmental Intervention.
References:
1. Ahuja, Ram (2003), Social Problems in India, Rawat Publication, Jaipur.
2. Extent, Pattern and Trend of Drug Use in India, Ministry of Social Justice and
   Publication.
   Epidemiological Unit, All India Institute of Medical Sciences, 2004.
8. Ross Coomber and Others. 2013, Key Concept in Drugs and Society. New Delhi: Sage
   Publications.
   Publications.
    Guru Nanak Dev University.
11. Singh, Chandra Paul 2000. Alcohol and Dependence among Industrial Workers: Delhi:
    Shipra.
    Cambridge University Press.
BACHELOR OF VOCATION (B.VOC.) (DATA SCIENCE)
SEMESTER – II

Paper–I: Introduction to Data Science
(Theory)

Time: 3 Hours

Max.Marks: 75

Instructions for the Paper Setters:–
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SECTION-A

Statistical Inference - Populations and samples - Statistical modeling, probability distributions, fitting a model - Intro to R
Exploratory Data Analysis and the Data Science Process - Basic tools (plots, graphs and summary statistics) of EDA - Philosophy of EDA - The Data Science Process - Case Study: RealDirect (online real estate firm)

SECTION-B

Three Basic Machine Learning Algorithms - Linear Regression - k-Nearest Neighbors (k-NN) - k-means
One More Machine Learning Algorithm and Usage in Applications - Motivating application: Filtering Spam - Why Linear Regression and k-NN are poor choices for Filtering Spam - Naive Bayes and why it works for Filtering Spam - Data Wrangling: APIs and other tools for scrapping the Web
Feature Generation and Feature Selection (Extracting Meaning From Data) - Motivating application: user (customer) retention - Feature Generation (brainstorming, role of domain expertise, and place for imagination) - Feature Selection algorithms – Filters; Wrappers; Decision Trees; Random Forests

SECTION-C


Mining Social-Network Graphs - Social networks as graphs - Clustering of graphs - Direct discovery of communities in graphs - Partitioning of graphs - Neighborhood properties in graphs
Data Visualization - Basic principles, ideas and tools for data visualization
- Examples of inspiring (industry) projects
- Exercise: create your own visualization of a complex dataset

Data Science and Ethical Issues - Discussions on privacy, security, ethics
- A look back at Data Science
- Next-generation data scientists

Text Books:
3. Jiawei Han, Micheline Kamber and Jian Pei. Data Mining: Concepts and Techniques, Third Edition.
Paper-II: Basic Mathematics  
(Theory)

Time: 3 Hours  
Max. Marks: 75

Instructions for the Paper Setters:-
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A
Solution of Simultaneous Linear Equations (upto two variable case), Solution of Quadratic Equations. Series: Arithmetic Progression Series, Geometric Progression Series

SECTION-B
Permutations and Combinations, Binomial Theorem, Determinants with simple applications for solution of Linear simultaneous equations using Cramer’s Rule, Matrices with simple application for solution of linear simultaneous equations using matrix inversion method.

SECTION-C
Real number systems, constants and variables, functions. Graphical representations of functions, limits and continuity of functions, first principle of differential calculus, derivations of simple algebraic functions and application of derivatives in Economic and Commerce. Maximum and minimum.

SECTION-D

Books Recommended:
4. Linear Programming by Thomas S. Ferguson
Instructions for the Paper Setters:-
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION - A
Introduction and preliminaries: The R environment , Related software and documentation , R and statistics, R and the window system, Using R interactively, An introductory session ,Getting help with functions and features, R commands, case sensitivity, Recall and correction of previous commands, Executing commands from or diverting output to a file ,Data permanency and removing objects2 Simple manipulations; numbers and vectors
Vectors and assignment, Vector arithmetic, Generating regular sequences, Logical vectors, Missing values, Character vectors, Index vectors; selecting and modifying subsets of a data set, Other types of objects
Objects, their modes and attributes: Intrinsic attributes: mode and length, Changing the length of an object, Getting and setting attributes, The class of an object

SECTION - B
Ordered and unordered factors: A specific example , The function tapply() and ragged arrays, Ordered factors
Arrays and matrices: Arrays, Array indexing. Subsections of an array, Index matrices, The array() function, Mixed vector and array arithmetic. The recycling rule, The outer product of two arrays, Generalized transpose of an array, Matrix facilities, Matrix multiplication, Linear equations and inversion, Eigenvalues and eigenvectors, Singular value decomposition and determinants, Least squares fitting and the QR decomposition, Forming partitioned matrices, cbind() and rbind(),The concatenation function, c(), with arrays, Frequency tables from factors.
Lists and data frames: Lists., Constructing and modifying lists, Concatenating lists, Data frames, Making data frames, attach() and detach(),Working with data frames, Attaching arbitrary lists, Managing the search path
Reading data from files: The read.table() function, The scan() function., Accessing built in datasets, Loading data from other R packages, Editing data

SECTION - C
Probability distributions R as a set of statistical tables, Examining the distribution of a set of data, One- and two-sample tests
Grouping, loops and conditional execution, Grouped expressions, Control statements, Conditional execution: if statements, Repetitive execution: for loops, repeat and while
Writing your own functions: Simple examples, Defining new binary operators, Named arguments and defaults, The ‘...’ argument, Assignments within functions, More advanced examples, Efficiency factors in block designs, Dropping all names in a printed array, Recursive numerical integration, Scope, Customizing the environment, Classes, generic functions and object orientation
SECTION - D

Statistical Models in R: Defining statistical models; formulae, Contrasts, Linear models, Generic functions for extracting model information, Analysis of variance and model comparison, ANOVA tables, Updating fitted models, Generalized linear models, Families, The glm() function, Nonlinear least squares and maximum likelihood models, Least squares, Maximum likelihood, Some non-standard models

Graphical Procedures: High-level plotting commands, The plot() function, Displaying multivariate data, Display graphics, Arguments to high-level plotting functions, Low-level plotting commands, Mathematical annotation, Hershey vector fonts, Interacting with graphics, Using graphics parameters, Permanent changes: The par() function, Temporary changes: Arguments to graphics functions, Graphics parameters list, Graphical elements, Axes and tick marks, Figure margins, Multiple figure environment, Device drivers, PostScript diagrams for typeset documents, Multiple graphics devices, Dynamic graphics

Packages, Standard packages: Contributed packages and CRAN, Namespaces

OS facilities: Files and directories, Filepaths, System commands, Compression and Archives.

Text/References:
1. An Introduction to R by W. N. Venables
3. R in Action: Data Analysis and Graphics with R by Robert Kabacoff
Paper–IV: Practical Based on Programming in R
(Practical)

Time: 3 Hours

Max. Marks: 75

Note: Practical exam to be conducted by the external examiner.

Practical Based on Programming in R
PAPER-V: COMMUNICATION SKILLS IN ENGLISH – II

Time: 3 Hours

Max. Marks: 50
Theory Marks: 35
Practical Marks: 15

Instructions for the Paper Setters:-
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Contents:

SECTION–A
Listening Skills: Barriers to listening; effective listening skills; feedback skills.
Activities: Listening exercises – Listening to conversation, News and TV reports

SECTION–B
Attending telephone calls; note taking and note making.
Activities: Taking notes on a speech/lecture

SECTION–C
Speaking and Conversational Skills: Components of a meaningful and easy conversation; understanding the cue and making appropriate responses; forms of polite speech; asking and providing information on general topics.
Activities: 1) Making conversation and taking turns
2) Oral description or explanation of a common object, situation or concept

SECTION–D
The study of sounds of English,
Stress and Intonation,
Situation based Conversation in English,
Essentials of Spoken English.
Activities: Giving Interviews

PRACTICAL / ORAL TESTING

Marks: 15

Course Contents:-
1. Oral Presentation with/without audio visual aids.
2. Group Discussion.
3. Listening to any recorded or live material and asking oral questions for listening comprehension.

Questions:-
1. Oral Presentation will be of 5 to 10 minutes duration (Topic can be given in advance or it can be student’s own choice). Use of audio visual aids is desirable.
2. Group discussion comprising 8 to 10 students on a familiar topic. Time for each group will be 15 to 20 minutes.

Note: Oral test will be conducted by external examiner with the help of internal examiner.
BACHELOR OF VOCATION (B.VOC.) (DATA SCIENCE)
SEMESTER – II

PAPER–VI: पैड़ाक्षि (खण्डभूमि)

माध्यम : 3 पृष्ठे तथा पृष्ठ-प्रमाण

मैवमल-ए

आउम अवहाम (कणकी जना).
(मंग. मुजिएब जीज अढे विधिवन्म रिप मंधु)
वाला तत्त्व ऐंठे पुरातात्विक, भागिवामल।
(विस्म-प्रमूं, बुजज दिवंगत)

मैवमल-बी

टिटिसिमल जनां (टिटिसिमल लेख-संग्रहीत)
मंग. स.स.अमेस्क, पैडक्ष्य मुदित पूर्वमल, भूप्लहए। (लेख 7 वं 12)
(माघ, रिंगट मैग)

मैवमल-बी

(इ) मन्द-धराल अवे मध्य वज्र : विज्ञामण, भूवेद मंबाम
(आ) भूम नुमान

मैवमल-बी

(इ) रिंगट वज्र
(आ) भूम नुमान अवेभ भक्ष

अव-बंद्र अवे विनिविष्ठ ऋषी उपष्टिक

1. भूमल बेंडल दे जल जल दीवली। उत जल दीवल दे भूमल बेंडल माँहो।
2. टिटिसिमल जनां दे बुजज पैं भूमल बंदल दी। उत जल दीवल दे भूमल भोजी दें।
3. उल्ले भूमल दे घाटन भक्ष गाँठ।
4. पैडक्ष्य मैंट बंदर दाला हैराल नेवल यं सं भूमल दी बेंडल भोजी दें। दें पैं जल चल
   दीव-भूमल दे जल वज्र दे।
BACHELOR OF VOCATION (B.VOC.) (DATA SCIENCE)
SEMESTER – II

PAPER-VI: ਇਸਤੇਖ਼ਰੀ ਪ੍ਰਸ਼ਨਾਣ
(In lieu of Compulsory Punjabi)

ਸਮੂਹ: 3 ਋ਠਿਆਂ
ਵੁਲ ਆਂਭ: 50

ਪ੍ਰਸ਼ਨ-ਸੂਚਿ

ਮੇਵਾਰਲਹ-੫੦੦੦

ਪ੍ਰਸ਼ਨਸ੍ਰੋਤ: ਪ੍ਰਸ਼ਨ ਅਤੇ ਲਹਤੁ
(ਸਲੀ, ਸਲੇਜ਼, ਸਾਲਟ, ਸਿਨੋਸਟ, ਸਿਨੋਸਟ, ਸਿੱਖਤਾ, ਸ਼ਾਹਸੀ, ਪ੍ਰਸ਼ਨ ਅਤੇ ਦਸਸ਼ਾਨਵ)

ਮੇਵਾਰਲਹ-੬੦੦੦

ਪ੍ਰਸ਼ਨਸ੍ਰੋਤ: ਪ੍ਰਸ਼ਨ ਲਹਤੁ
(ਵੀ) ਸਥਾਨਕ ਦੱਸ, ਸ਼ਾਹਸੀ ਦੱਸ ਅਤੇ ਕਾਫਸ਼ਾ ਦੱਸ (ਪ੍ਰਸ਼ਨ ਅਤੇ ਲਹਤੁ
(ਆ) ਸਿਨੋਸਟਕ ਦੱਸ, ਸਲੇਜ਼ ਦੱਸ ਅਤੇ ਸਲੇਜ਼ ਦੱਸ (ਪ੍ਰਸ਼ਨ ਅਤੇ ਲਹਤੁ

ਮੇਵਾਰਲਹ-੭੦੦੦

ਪ੍ਰਸ਼ਨ ਸਰਹਦ
ਮਹਿਣਦ ਸਰਹਦ

ਮੇਵਾਰਲਹ-੮੦੦੦

ਹੋਟੀ ਪ੍ਰਸ਼ਨ (ਕਾਲੀਸੂ ਅਤੇ ਕਾਲੂਤੀ)
ਅਤੇ ਅਤੇ ਇਕ ਧਰਾਤਲ

ਅੇਵ-ਇੱਕ ਅਤੇ ਗਾਲੀਵਾਲਾ ਲਿਸਤੀ ਉਪਾਧਿਆਂ

1. ਪ੍ਰਸ਼ਨ ਪ੍ਰਸ਼ਨ ਦੇ ਚਾਰ ਦਰਜਾ ਦੇਖੋ। ਉਹ ਦਰਜਾ ਦੀਚੇ ਦੇ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਨਾਲ ਦੇਖੋ।
2. ਲੁਖਸੂ ਦੀਚੇ ਦੇ ਬੁੱਧਾ ਪ੍ਰਸ਼ਨ ਵਕਤਾ ਦੇਖੋ। ਉਹ ਦਰਜਾ ਦੀਚੇ ਦੇਖੋ ਪ੍ਰਸ਼ਨ ਸਮਾਪਤ ਦੇਖੋ।
3. ਚਨੇ ਪ੍ਰਸ਼ਨ ਦੇ ਦਾਮਨ ਦੀਚੇ ਦੇਖੋ।
4. ਪ੍ਰਸ਼ਨ ਮੈਂਟ ਚਨਾ ਦਰਜਾ ਦੇਖੋ ਨਿਰੰਤਰ ਚਨਾ ਉਨ ਪ੍ਰਸ਼ਨ ਦੀਚੇ ਦੇ ਖ਼ਾਸ ਦੇਖੋ ਦੇਖੋ ਦੇਖੋ ਦੇਖੋ ਦੇਖੋ ਦੇਖੋ ਦੇਖੋ ਦੇਖੋ ਦੇਖੋ ਦੇਖੋ ਦੇਖੋ।
BACHELOR OF VOCATION (B.VOC.) (DATA SCIENCE)
SEMESTER – II

PAPER–VI: Punjab History & Culture (C 320 to 1000 B.C.)
(Special Paper in lieu of Punjabi compulsory)
(For those students who are not domicile of Punjab)

Time: 3 Hours
Max. Marks: 50

Instructions for the Paper Setters:-

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Section–A

1. Alexander’s Invasion and its Impact
2. Punjab under Chandragupta Maurya and Ashoka.

Section–B

3. The Kushans and their Contribution to the Punjab.
4. The Panjab under the Gupta Empire.

Section–C

5. The Punjab under the Vardhana Emperors
6. Socio-cultural History of Punjab from 7th to 1000 A.D.

Section–D

7. Development of languages and Education with Special reference to Taxila
8. Development of Art & Architecture

Suggested Readings:

1. L. M Joshi (Ed), History and Culture of the Punjab, Art-I, Punjabi University, Patiala, 1989 (3rd Edition)
BACHELOR OF VOCATION (B.VOC.) (DATA SCIENCE)
SEMESTER – II

PAPER – VII: DRUG ABUSE: PROBLEM, MANAGEMENT AND PREVENTION
(COMPULSORY PAPER)

DRUG ABUSE: MANAGEMENT AND PREVENTION

Time: 3 Hours Max. Marks: 50

Instructions for the Paper Setters:-
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Section – A

Prevention of Drug abuse:
Role of family: Parent child relationship, Family support, Supervision, Shaping values, Active Scrutiny.

Section – B

School: Counselling, Teacher as role-model. Parent-teacher-Health Professional Coordination, Random testing on students.

Section – C

Controlling Drug Abuse:
Media: Restraint on advertisements of drugs, advertisements on bad effects of drugs, Publicity and media, Campaigns against drug abuse, Educational and awareness program

Section – D

References:

Paper – I: Optimization
(THEORY)

Time: 3 Hours  Max. Marks: 50

Instructions for the Paper Setters:-
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Section-A
Meaning, significance, limitation and scope. Introduction to linear programming, formation of Linear Programming Problem, Graphical method Simplex Method.

Section-B
Two Phase Simplex Method, Duality in Linear Programming, Definition of Dual Problem, general rules of converting primal into its dual.

Section-C
Transportation Problem, Definition of Assignment Model, Hungarian Method for solution of Assignment Problems, Travelling Salesman Problem.

Section-D
Games Theory: Two persons zero sum games, pure strategies, mixed strategies, Dominance.

Text/References:
Instructions for Paper Setter:
The whole syllabus has been divided into four sections (A-D). Eight questions of equal marks (two from each section) in all will be set. Candidates are required to answer total five questions, selecting at least one question from each section. The fifth question may be from any section. Questions may have sub-parts, not more than four.

Section-A
Consumer Behaviour:

Section-B
Producer Behaviour:
Cost & Cost Curves- The Traditional theory of Cost (short run and long run).
Concept of Revenue- Total Revenue, Average Revenue and Marginal Revenue; their inter-relationship.

Section-C
Market Forms:
Perfect Competition- Meaning, Features. Conditions of Equilibrium; Price and Output determination of firm and industry.
Monopoly- Meaning, Features. Price and Output determination under Monopoly.
Monopolistic Competition- Meaning, Features. Price and Output determination under Monopolistic Competition.

Section-D
National Income:
Meaning, Definition and Importance of National Income.

Suggested Readings:
Instructions for the Paper Setters:-
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Section-A
Cumulative distribution function, Two dimensional random variables, joint distribution, marginal and conditional distributions, Stochastic independence, Introduction to function of random variables.

Section-B
Mathematical expectations and moments, moment generating function and its properties. Chebyshev’s inequality and its application, central limit theorem (Laplace Theorem)

Section-C
Discrete Probability Distributions: Binomial, Poisson, Geometric, Continuous probability distributions: Uniform, Exponential, Gamma, Beta, Normal distributions.

Section-D
Sampling Distributions: Chi-square, t and F-distributions with their properties, distribution of sample mean and variance. Introduction to Estimators, Types of Estimators.

Text/References:
Paper–IV: Data Mining
(THEORY)

Time: 3 Hours                                                                                                       Max. Marks: 75

Instructions for the Paper Setters:-
Eight questions of equal marks (specified in the syllabus) are to be set, two in each of the four Sections (A–D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Section A
Data Warehousing: Architecture of a data warehouse; Differences between Online Transaction Processing (OLTP) and Online Analytical Processing (OLAP).

Section B
From Data Warehousing to Data Mining, Why Data Mining, What Is Data Mining, What Kinds of Data Can Be Mined, What Kinds of Patterns Can Be Mined, Which Technologies Are Used, Which kinds of applications are Targeted, Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining systems.

Section C
Major issues in Data Mining: Data preprocessing Descriptive data mining: characterization and comparison.
Data mining techniques: Association rule analysis Cluster analysis: Types of data – Clustering Methods – Partitioning methods – Model based clustering methods
Outlier Detection: Outliers and Outlier Analysis, Outlier Detection Methods: Supervised, Semi-Supervised, and Unsupervised Methods, Statistical Methods, Proximity-Based Methods, and Clustering-Based Methods. Statistical Approaches, Parametric Methods, Nonparametric Methods, Proximity-Based Approaches: Distance-Based Outlier Detection and a Nested Loop Method, A Grid-Based Method, Density-Based Outlier Detection, Clustering-Based Approaches, Classification-Based Approaches, Mining Contextual and Collective Outliers, Outlier Detection in High-Dimensional Data.

Section D
Classification – Decision Tree Induction – Bayesian Classification – Prediction – Back Propagation Case studies in Data Mining applications.
Data Mining Trends and Research Frontiers, Mining Complex Data Types, Mining Sequence Data: Time-Series, Symbolic Sequences, and Biological Sequences, Mining Graphs and Networks, Mining Other Kinds of Data, Other Methodologies of Data Mining, Statistical Data Mining, Views on Data Mining Foundations, Visual and Audio Data Mining.

References:
1. Data Mining: Concepts and Techniques, Jiawei Han, Micheline Kamber, Morgan Kaufmann; 2nd Edition (2006)
2. Data Mining Introductory and Advanced Topics –Margaret H Dunham, Pearson Education
BACHELOR OF VOCATION (B.VOC.) (DATA SCIENCE)
SEMESTER – III

Paper–V: Practical Based on SAS
(PRACTICAL)

Time: 3 Hours
Max. Marks: 75

Note: Eight Programs of equal marks (Specified In the syllabus) are to be set, two in each of the four sections(A-D). Candidates are requested to attempt four programs, selecting at least one question one question from each section.

Section A
SETTING UP THE SAS SOFTWARE ENVIRONMENT
What does SAS do? What is your preparation of SAS? Let’s get started with your free version of SAS, history of SAS interfaces.
SAS Studio web-based GUI: Describing the rest of SAS Studio
(SAS Studio section- Server files and folders, tasks and utilities, snippets, libraries, file shortcuts)
SAS data storage: the SAS dataset, the SAS scalable performance data engine, the scalable performance data server, SAS HDAT, SAS formats and informats, date and time data

Section B
WORKING WITH DATA USING SAS SOFTWARE
Preparing data for analytics: making data in SAS, Data step to make data, PROCSQL to make data
Working with external data: data step code for importing external data, PROC IMPORT, Referencing external files directly referencing external files, indirectly referencing external files.
Specialty PROCs for working with external data: PROC HADOOP AND PROC HDMD, PROC JSON
Specialty PROCs for working with computer languages: PROC GROOVY, LUA

Section C
DATA PREPARATION USING SAS DATA STEP AND SAS PROCEDURES
Data preparation for analytics: Creating indicators for the first and last observation in a by group transposing: PROC TRANSPOSE, SAS studio transpose data task.
Statistical and Mathematical data transformations: PROC MEANS, Imputation, Identifying missing values, Characterizing data, List Tables Attributes.
SAS macro facility: macro variables, macros.

Section D
ANALYSIS WITH SAS SOFTWARE Analytics
Description and predictive analysis, descriptive analysis: PROC FREQ, CORR, UNIVARIATE.
Predictive analysis: regression analysis, PROC REG.
Forecasting analysis: PROC TIMEDATA, ARIMA.
Optimization analysis: SASA/IML, Interacting with the R programming language, PROC IML.
BACHELOR OF VOCATION (B.VOC.) (DATA SCIENCE)
SEMESTER – III

PAPER-VI: INTRODUCTION TO PYTHON
(PRACTICAL)

Time: 3 Hours Max. Marks: 75

Note: Eight programs of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Candidates are required to attempt four programs, selecting at least one question from each Section.

SECTION-A
Python Programming Language Data and Expressions: Literals, Variables and Identifiers, Operators, Expressions, Statements and Data Types
Control Structures: Boolean Expressions (Conditions), Logical Operators, Selection Control, Nested conditions
Lists: List Structures, Lists (Sequences) in Python, Iterating Over Lists (Sequences) in Python

SECTION-B
Functions: Fundamental Concepts, Program Routines, Flow of Execution, Parameters & Arguments
Iteration: While statement, Definite loops using For, Loop Patterns, Recursive Functions

SECTION-C
Dictionaries: Dictionaries and Files, Looping and dictionaries
Files: Opening Files, Using Text Files, String Processing, Exception Handling

SECTION-D
Objects and Their Use: Introduction to Object Oriented Programming
Modular Design: Modules, Top-Down Design, Python Modules
Using Databases and SQL: Database Concepts, SQLite Manager Firefox Add-on, SQL basic summary, Basic Data modeling, Programming with multiple tables

Reference Books:
1. Python for Informatics, Charles Severance, version 0.0.7
BACHELOR OF VOCATION (B.VOC.) (DATA SCIENCE)
SEMESTER – IV

Paper–I: Basics of Linear Algebra & Numerical Analysis
(THEORY)

Time: 3 Hours Max. Marks: 50

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A
Definition of groups, rings and fields with examples. Definition of a vector space, subspaces with examples. Linear dependence, Linear independence of vectors. Linear combination of vectors

SECTION-B

SECTION-C
Numerical Differentiation, Numerical Integration: Trapezoidal rule, Simpson’s 1/3 rule, Simpson’s 3/8 rule

SECTION-D

Books Recommended:
6. A. Maritava Gupta and Subash Ch. Bose: Introduction to Numerical Analysis
Paper – II: Statistical Inference-II
(THEORY)

Time: 3 Hours
Max. Marks: 50

Instructions for the Paper Setters:-
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Section-A
Basics of Estimators: Properties of unbiasedness, consistency, sufficiency, efficiency, completeness, uniqueness (Without Proofs)

Section-B
Applications of Sampling Distributions: Test of mean and variance in the normal distribution, Tests of single proportion and equality of two proportions, Chi-square test, t-test, F-test.

Section-C
Statistical Hypothesis: Null hypothesis, Alternate hypothesis, Level of Significance, simple and composite hypothesis Steps in solving Testing of hypothesis problem, Neyman Pearsom Lemma.

Section-D
Introduction to ANOVA (Analysis of variance), One way Analysis of variance, Two way Analysis of variance. Problem based on ANOVA.

Text/References:

Instructions for the Paper Setters:-
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A
Introduction: Introduction to Algorithms and Heuristics, Comparison of Algorithms and Heuristics

SECTION-B
Retrieval Utilities: Relevance Feedback, Clustering, Passage Based Retrieval, N-Grams, Regression Analysis, Semantic Networks, Parsing
Cross-Language Information Retrieval: Crossing the Language barrier, Cross-Language Retrieval Strategies, Cross Language Utilities

SECTION-C
Efficiency: Inverted Index, Query Processing, Signature Files, Duplicate Document Detection
Integrating Structured Data and Text: Review of the Relational Model, Information retrieval as a Relational Application, Multidimensional Data Model

SECTION-D
Parallel Information Retrieval: Parallel Text Scanning, Parallel Indexing, Clustering and Classification
Distributed Information Retrieval: A Theoretical model of Distributed retrieval, Web Search, Result Fusion, Peer-to-Peer Information Systems

References:
1) Information Retrieval systems : Theory and Implementation by Gerald Kowalski
2) Cross- Language Information Retrieval: by Gregory Grefenstette
3) Text Retrieval and Filtering: Analytics Models of Performance by Robert M. Losee
Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Section A
Exploring the Use of Big Data in Business Context: Use of Big Data in Social Networking, Use of Big Data in Preventing Fraudulent Activities, Use of Big Data in Detecting Fraudulent Activities in Insurance Sector, Use of Big Data in Retail Industry.

Section B
Understanding Hadoop Ecosystem: Hadoop Ecosystem, Hadoop Distributed File System, MapReduce, Hadoop YARN, Introducing HBase, Combining HBase and HDFS, Hive, Pig and Pig Latin, Sqoop, ZooKeeper, Flume, Oozie.
Understanding MapReduce Fundamentals and HBase: The MapReduce Framework, Techniques to Optimize MapReduce Jobs, Uses of MapReduce, Role of HBase in Big Data Processing.
Understanding Big Data Technology Foundations: Exploring the Big Data Stack, Virtualization and Big Data, Virtualization Approaches, Summary, Quick Revise

Section – C
Storing Data in Databases and Data Warehouses: RDBMS and Big Data, Non-Relational Database, Polyglot Persistence, Integrating Big Data with Traditional Data Warehouses, Big Data Analysis and Data Warehouse, Changing Deployment Models in Big Data Era.
Processing Your Data with MapReduce: Recollecting the Concept of MapReduce Framework, Developing Simple MapReduce Application, Points to Consider while Designing MapReduce.
Section – D

Customizing MapReduce Execution and Implementing MapReduce Program: Controlling MapReduce Execution with InputFormat, Reading Data with Custom RecordReader, Organizing Output Data with OutputFormats, Customizing Data with RecordWriter, Optimizing MapReduce Execution with Combiner, Controlling Reducer Execution with Partitioners, Customizing the MapReduce Execution in Terms of YARN, Implementing a MapReduce Program for Sorting Text Data.

Testing and Debugging MapReduce Applications: Debugging Hadoop MapReduce Locally, Performing Unit Testing for MapReduce Applications, Performing Local Application Testing with Eclipse, Logging for Hadoop Testing, Application Log Processing, Defensive Programming in MapReduce.

References:
2. Big-Data Black Book, DT Editorial Services, Wiley India
Note: Eight Programs of equal marks (Specified In the syllabus) are to be set, two in each of the four sections (A-D). Candidates are requested to attempt four programs, selecting at least one question one question from each section.

Section A
Understanding Analytics and Big Data: Comparing Reporting and Analysis, Types of Analytics, Points to Consider during Analysis, Developing an Analytic Team, Understanding Text Analytics,

Section B

Section C
Reading Datasets and Exporting Data from R: Using the c() Command, Using the scan() Command, Reading Multiple Data Values from Large Files, Reading Data from RStudio, Exporting Data from R.
Manipulating and Processing Data in R: Selecting the Most Appropriate Data Structure, Creating Data Subsets, Merging Datasets in R, Sorting Data, Putting Your Data into Shape, Managing Data in R Using Matrices, Managing Data in R Using Data Frames

Section D
Working with Functions and Packages in R: Using Functions Instead of Scripts, Using Arguments in Functions, Built-in Functions in R, Introducing Packages, Working with PackagesPerforming Graphical Analysis in R: Using Plots, Saving Graphs to External Files, Advanced Features of R

References:
2. Big-Data Black Book, DT Editorial Services, Wiley India
Note: Eight Programs are to be set, two in each of the four Sections (A-D). Candidates are required to attempt four programs, selecting at least one question from each Section.

SECTION–A

SECTION–B
Solution of System of Linear Equations: Gauss Elimination Method, Gauss Jordan Method, Gauss Seidel method

SECTION–C
Numerical Differentiation: Function tabulated at equal intervals, Function tabulated at unequal intervals.

SECTION–D
Curve Fitting: Method of Least square, Fitting Straight line, Fitting a polynomial

Books Recommended:
2. B.S. Grewal, Numerical Methods for Engineering, Sultan Chand Publication
Teaching Methodologies
The Core Module Syllabus for Environmental Studies includes class room teaching and field work. The syllabus is divided into 8 Units [Unit-1 to Unit-VII] covering 45 lectures + 5 hours for field work [Unit-VIII]. The first 7 Units will cover 45 lectures which are class room based to enhance knowledge skills and attitude to environment. Unit-VIII comprises of 5 hours field work to be submitted by each candidate to the Teacher in-charge for evaluation latest by 15 December, 2019.

Exam Pattern:
End Semester Examination - 75 marks
Project Report/Field Study - 25 marks [based on submitted report]
Total Marks - 100

The structure of the question paper being:

Part-A, Short answer pattern with inbuilt choice – 25 marks
Attempt any five questions out of seven distributed equally from Unit-1 to Unit-VII. Each question carries 5 marks. Answer to each question should not exceed 2 pages.

Part-B, Essay type with inbuilt choice – 50 marks
Attempt any five questions out of eight distributed equally from Unit-1 to Unit-VII. Each question carries 10 marks. Answer to each question should not exceed 5 pages.

Project Report / Internal Assessment:

Part-C, Field work – 25 marks [Field work equal to 5 lecture hours]
The candidate will submit a hand written field work report showing photographs, sketches, observations, perspective of any topic related to Environment or Ecosystem. The exhaustive list for project report/area of study are given just for reference:

1. Visit to a local area to document environmental assets: River / Forest/ Grassland / Hill / Mountain / Water body / Pond / Lake / Solid Waste Disposal / Water Treatment Plant / Wastewater Treatment Facility etc.
2. Visit to a local polluted site – Urban / Rural / Industrial / Agricultural
3. Study of common plants, insects, birds
4. Study of tree in your areas with their botanical names and soil types
5. Study of birds and their nesting habits
6. Study of local pond in terms of wastewater inflow and water quality
7. Study of industrial units in your area. Name of industry, type of industry, Size (Large, Medium or small scale)
8. Study of common disease in the village and basic data from community health centre
9. Adopt any five young plants and photograph its growth
10. Analyze the Total dissolved solids of ground water samples in your area.
11. Study of Particulate Matter (PM\textsubscript{2.5} or PM\textsubscript{10}) data from Sameer website. Download from Play store.
12. Perspective on any field on Environmental Studies with secondary data taken from Central Pollution Control Board, State Pollution Control Board, State Science & Technology Council etc.
Unit-I

The multidisciplinary nature of environmental studies
Definition, scope and importance, Need for public awareness

(2 lectures)

Unit-II

Natural Resources: Renewable and non-renewable resources:
Natural resources and associated problems.
(a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
(b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
(c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
(d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
(e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.
(f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
- Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

(8 Lectures)

Unit-III

Ecosystems
- Concept of an ecosystem
- Structure and function of an ecosystem
- Producers, consumers and decomposers
- Energy flow in the ecosystem
- Ecological succession
- Food chains, food webs and ecological pyramids
- Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)

(6 Lectures)

Unit-IV

Biodiversity and its conservation
- Introduction – Definition: genetic, species and ecosystem diversity
- Biogeographical classification of India
- Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values
- Biodiversity at global, national and local levels
- India as a mega-diversity nation
- Hot-spots of biodiversity
- Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts
- Endangered and endemic species of India
- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

(8 Lectures)
Unit-V

Environmental Pollution:
Definition:
- Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear pollution
- Solid waste management: Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution
- Pollution case studies
- Disaster management: floods, earthquake, cyclone and landslides (8 Lectures)

Unit-VI

Social Issues and the Environment
- From unsustainable to sustainable development
- Urban problems and related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people; its problems and concerns. Case studies.
- Environmental ethics: Issues and possible solutions
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
- Wasteland reclamation
- Consumerism and waste products
- Environmental Protection Act, 1986
- Air (Prevention and Control of Pollution) Act, 1981
- Water (Prevention and control of Pollution) Act, 1974
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation
- Public awareness (7 Lectures)

Unit-VII

Human Population and the Environment
- Population growth, variation among nations
- Population explosion – Family Welfare Programmes
- Environment and human health
- Human Rights
- Value Education
- HIV / AIDS
- Women and Child Welfare
- Role of Information Technology in Environment and Human Health
- Case Studies (6 Lectures)
Field Work
- Visit to a local area to document environmental assets River / forest / grassland / hill / mountain
- Visit to a local polluted site – Urban / Rural / Industrial / Agricultural
- Study of common plants, insects, birds
- Study of simple ecosystems-pond, river, hill slopes, etc

(Field work equal to 5 lecture hours)

References:
2. Down to Earth, Centre for Science and Environment, New Delhi.
9. State of India’s Environment 2018 by Centre for Sciences and Environment, New Delhi