FACULTY OF ENGINEERING & TECHNOLOGY

BATCH FROM YEAR 2025 TO YEAR 2029

Bachelor of Computer Applications (Honours)

SEMESTER: I–VIII

(Credit Based Grading System)

GURU NANAK DEV UNIVERSITY
AMRITSAR

(ii) Subject to change in the syllabi at any time.
Please visit the University website time to time.

Bachelor of Computer Applications (Honours) (CBGS)
Syllabus for the Batch from Year 2025 to Year 2029

SEMESTER – I

Sr. No.	Subject Code	Subject	Credits L T P	Total Marks
1	**BCA01005T**	Computer Fundamentals & PC Software	3-0-0	75
	BCA01006L	Lab-1 based on Computer Fundamentals & PC Software	0-0-1	25
2	**BCA01010T**	Introduction to Programming using Python	3-0-0	75
	BCA01011L	Lab-2 based on Introduction to Programming using Python	0-0-1	25
3	**BCA01003T**	Applied & Discrete Mathematics	4-0-0	100
4	**BCA01008T**	Introduction to the Internet **(SEC-1 Theory)**	2-0-0	50
6	**BCA01009L**	Lab-3 based on Introduction to the Internet **(SEC-1) (Practical)**	0-0-1	25
7	**ENL121**	Communication Skills in English– I **(MDC-4)**	4-0-0	100
8	**PBL601** **PBL611** **PHC110**	Punjabi Compulsory -1/ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ–1 **OR** *ਮੁੱਢਲੀ ਪੰਜਾਬੀ–1/Mudhli Punjabi-1 **OR** * Punjab History & Culture (From Earliest Times to C 320)	4-0-0	100
		Total credits	**23**	**575**

***Special Note:-**

1. ਜਿਹੜੇ ਵਿਦਿਆਰਥੀ **Domicile/Non-Domicile of Punjab** ਹਨ ਅਤੇ ਉਨ੍ਹਾਂ ਨੇ ਅੱਠਵੀ/ਦਸਵੀਂ ਜਮਾਤ ਤੱਕ ਪੰਜਾਬੀ ਵਿਸ਼ਾ ਪੜ੍ਹਿਆ ਹੈ, ਉਹ ਵਿਦਿਆਰਥੀ ਪੰਜਾਬੀ (ਲਾਜ਼ਮੀ) ਪੜ੍ਹਨਗੇ।
2. ਜਿਹੜੇ ਵਿਦਿਆਰਥੀ **Non-Domicile of Punjab** ਹਨ ਅਤੇ ਅੱਠਵੀ/ਦਸਵੀਂ ਜਮਾਤ ਤੱਕ ਪੰਜਾਬੀ ਵਿਸ਼ਾ ਨਹੀਂ ਪੜ੍ਹਿਆ ਹੈ, ਉਹ ਮੁੱਢਲੀ ਪੰਜਾਬੀ ਜਾਂ ਪੰਜਾਬ ਹਿਸਟਰੀ ਐਂਡ ਕਲਚਰ ਵਿੱਚੋਂ ਕੋਈ ਇੱਕ ਵਿਸ਼ਾ ਚੁਣ ਸਕਦੇ ਹਨ।
3. ਜਿਹੜੇ ਵਿਦਿਆਰਥੀ **Domicile of Punjab** ਹਨ, ਪੰਤੂ ਕਿਸੇ ਕਾਰਣ ਪੰਜਾਬ ਤੋਂ ਬਾਹਰ ਪੜ੍ਹੇ ਹਨ ਅਤੇ ਉਨ੍ਹਾਂ ਨੇ ਅੱਠਵੀ/ਦਸਵੀਂ ਜਮਾਤ ਤੱਕ ਪੰਜਾਬੀ ਵਿਸ਼ਾ ਨਹੀਂ ਪੜ੍ਹਿਆ ਹੈ, ਉਹ ਮੁੱਢਲੀ ਪੰਜਾਬੀ ਦਾ ਹੀ ਵਿਸ਼ਾ ਪੜ੍ਹਣਗੇ।
4. ਜਿਹੜੇ ਵਿਦਿਆਰਥੀ **Domicile of Punjab** ਹਨ ਅਤੇ ਪੰਜਾਬ ਦੇ ਕੇਂਦਰੀ ਵਿਦਿਆਲਿਆ ਜਾਂ ਕਿਸੇ ਹੋਰ ਸਕੂਲ ਵਿੱਚ ਪੜ੍ਹੇ ਹਨ ਅਤੇ ਕਿਸੇ ਕਾਰਣ ਉਨ੍ਹਾਂ ਨੇ ਅੱਠਵੀ/ਦਸਵੀਂ ਜਮਾਤ ਤੱਕ ਪੰਜਾਬੀ ਵਿਸ਼ਾ ਨਹੀਂ ਪੜ੍ਹਿਆ ਹੈ, ਉਹ ਮੁੱਢਲੀ ਪੰਜਾਬੀ ਦਾ ਵਿਸ਼ਾ ਹੀ ਪੜ੍ਹਣਗੇ।

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SEMESTER – II

Sr. No.	Subject Code	Subject	Credits L T P	Total Marks
1		Introduction to C Programming	3-0-0	75
2		Lab-1 based on C Programming	0-0-1	25
3		Principles of Digital Electronics	4-0-0	100
4		Numerical Methods & Statistical Techniques	4-0-0	100
5	**SOA105**	Drug Abuse: Problem, Management and Prevention (**Value Added Course) (VAC-1)**	2-0-0	50
6	**ENL122**	Communication Skills in English– II (Theory) **(AEC-4)**	3-0-0	75
7	**ENP122**	Communication Skills in English– II (Practical)	0-0-1	25
8	**PBL602** **OR** **PBL612** **OR** **PHC111**	Punjabi Compulsory-2/ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ–2 *Mudhli Punjabi-2/ਮੁੱਢਲੀ ਪੰਜਾਬੀ–2 * Punjab History & Culture (C 320 TO 1000 A.D.)	4-0-0	100
		Total credits	**22**	**550**

***Special Note:-**

1. ਜਿਹੜੇ ਵਿਦਿਆਰਥੀ **Domicile/Non-Domicile of Punjab** ਹਨ ਅਤੇ ਉਨ੍ਹਾਂ ਨੇ ਅੱਠਵੀ/ਦਸਵੀਂ ਜਮਾਤ ਤੱਕ ਪੰਜਾਬੀ ਵਿਸ਼ਾ ਪੜ੍ਹਿਆ ਹੈ, ਉਹ ਵਿਦਿਆਰਥੀ ਪੰਜਾਬੀ (ਲਾਜ਼ਮੀ) ਪੜ੍ਹਨਗੇ।
2. ਜਿਹੜੇ ਵਿਦਿਆਰਥੀ **Non-Domicile of Punjab** ਹਨ ਅਤੇ ਅੱਠਵੀ/ਦਸਵੀਂ ਜਮਾਤ ਤੱਕ ਪੰਜਾਬੀ ਵਿਸ਼ਾ ਨਹੀਂ ਪੜ੍ਹਿਆ ਹੈ, ਉਹ ਮੁੱਢਲੀ ਪੰਜਾਬੀ ਜਾਂ ਪੰਜਾਬ ਹਿਸਟਰੀ ਐਂਡ ਕਲਚਰ ਵਿੱਚੋਂ ਕੋਈ ਇੱਕ ਵਿਸ਼ਾ ਚੁਣ ਸਕਦੇ ਹਨ।
3. ਜਿਹੜੇ ਵਿਦਿਆਰਥੀ **Domicile of Punjab** ਹਨ, ਪੰਤੂ ਕਿਸੇ ਕਾਰਣ ਪੰਜਾਬ ਤੋਂ ਬਾਹਰ ਪੜ੍ਹੇ ਹਨ ਅਤੇ ਉਨ੍ਹਾਂ ਨੇ ਅੱਠਵੀ/ਦਸਵੀਂ ਜਮਾਤ ਤੱਕ ਪੰਜਾਬੀ ਵਿਸ਼ਾ ਨਹੀਂ ਪੜ੍ਹਿਆ ਹੈ, ਉਹ ਮੁੱਢਲੀ ਪੰਜਾਬੀ ਦਾ ਹੀ ਵਿਸ਼ਾ ਪੜ੍ਹਣਗੇ।
4. ਜਿਹੜੇ ਵਿਦਿਆਰਥੀ **Domicile of Punjab** ਹਨ ਅਤੇ ਪੰਜਾਬ ਦੇ ਕੇਂਦਰੀ ਵਿਦਿਆਲਿਆ ਜਾਂ ਕਿਸੇ ਹੋਰ ਸਕੂਲ ਵਿੱਚ ਪੜ੍ਹੇ ਹਨ ਅਤੇ ਕਿਸੇ ਕਾਰਣ ਉਨ੍ਹਾਂ ਨੇ ਅੱਠਵੀ/ਦਸਵੀਂ ਜਮਾਤ ਤੱਕ ਪੰਜਾਬੀ ਵਿਸ਼ਾ ਨਹੀਂ ਪੜ੍ਹਿਆ ਹੈ, ਉਹ ਮੁੱਢਲੀ ਪੰਜਾਬੀ ਦਾ ਵਿਸ਼ਾ ਹੀ ਪੜ੍ਹਣਗੇ।

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SEMESTER-III

Sr. No.	Subject Code	Subject	Credits L T P	Total Marks
1.		Data Structures & File Processing	3-0-0	75
2.		Lab-1 based on Data Structures & File Processing	0-0-1	25
3.		Computer Architecture	4-0-0	100
4.		Operating Systems	4-0-0	100
5.		Cybersecurity Fundamentals **(SEC-2 Theory)**	2-0-0	50
6.		Lab-2 based on Cybersecurity Fundamentals **(SEC-2 Practical)**	0-0-1	25
7.		Information Systems **(MDC-5)**	4-0-0	100
8.		Internship with local public/private industry/ business /organization Field Practice – 3	0-0-2	50
		Total credits	**21**	**525**

SEMESTER-IV

Sr. No.	Subject Code	Subject	Credits L T P	Total Marks
1.		Introduction to C++ Programming	3-0-0	75
2.		Lab-1 based on Introduction to C++ Programming	0-0-1	25
3.		Database Management Systems	3-0-0	75
4.		Lab-2 based on Database Management Systems	0-0-1	25
5.		Computer Networks	4-0-0	100
6.		Security in Computing **(Minor)**	4-0-0	100
7.	ESL222	Environment Studies (**Value Added Course) (VAC-2)**	2-0-0	50
		Compiler Design **(AEC-5)**	4-0-0	100
		Total credits	**22**	**550**

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SEMESTER-V

Sr. No.	Subject Code	Subject	Credits L T P	Total Marks
1.		Computer Graphics	3-0-0	75
2.		Lab-1 based on Computer Graphics using C++	0-0-1	25
3.		Web Designing & Development	3-0-0	75
4.		Lab-2 based on Web Designing & Development	0-0-1	25
5.		Ethical Hacking **(MDC-6)**	3-0-0	75
6.		Lab-3 Based on Ethical Hacking	0-0-1	25
7.		Software Engineering	4-0-0	100
8.		Server-side Programming **(SEC-3 Theory)**	2-0-0	50
9.		Lab-4 Based on Server-side Programming **(SEC-3 Practical)**	0-0-1	25
10.		Internship with local public/private industry/ business /organization Field Practice – 4	0-0-2	50
		Total credits	**21**	**475**

SEMESTER-VI

Sr. No.	Subject Code	Subject	Credits L T P	Total Marks
1.		Programming in Java **(Theory)**	3-0-0	75
2.		Lab-1 based on Programming in Java **(Practical)**	0-0-1	25
3.		* Software Project	0-0-12	300
4.		Advanced Web Development **(Minor Theory)**	3-0-0	75
5.		Lab-2 based on Advanced Web Development **(Minor Practical)**	0-0-1	25
6.	PSL061	Human Rights and Constitutional Duties (**Value Added Course) (VAC-3)**	2-0-0	50
		Total credits	**22**	**550**

Note: * The Software Project Paper as per the University Template IV (Under NEP) covers three DSCs papers.

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SEMESTER-VII

Sr. No.	Subject Code	Subject	Credits L T P	Total Marks
1.		Cloud Computing	4-0-0	100
2.		Entrepreneurship Development	4-0-0	100
3.		Mobile Application Development	3-0-0	75
4.		Lab-1: Based on Mobile Application Development	0-0-1	25
5.		Artificial Intelligence	4-0-0	100
6.		Data Analytics **(Minor-1 Theory)**	3-0-0	75
7.		Lab-2: Based on Data Analytics **(Minor-1 Practical)**	0-0-1	25
8.		Internship with local public/private/Govt. industry/ business /organization Field Practice – 5	0-0-2	50
		Total credits	**22**	**550**

SEMESTER-VIII
(Same as opted in semester-VII)

Sr. No.	Subject Code	Subject	Credits L T P	Total Marks
1.		Internet Technology and Protocols	4-0-0	100
2.		Technology & Ethics	4-0-0	100
3.		Cross-Platform Mobile Application Development	3-0-0	75
4.		Lab-1 based on Cross-Platform Mobile Development	0-0-1	25
5.		Machine Learning	3-0-0	75
6.		Lab-2 based on Machine Learning	0-0-1	25
7.		Data Visualization**(Minor 2 Theory)**	3-0-0	75
8.		Lab-3 based on Data Visualization **(Minor 2 Practical)**	0-0-1	25
		Total credits	**20**	**500**

Total Credits: 173

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SEMESTER-I

BCA01005T: Computer Fundamentals & PC Software

M. Marks: 75
Time: 3 Hours

Credits
L-T-P
3-0-0
(60 Hrs)

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 outcomes:

- learn the functioning of various components of a computer system.
- identify input and output devices and storage devices.
- getting familiar with software.
- create documents, spreadsheets, and presentations

SECTION–A (15 Hrs.)

Introduction to Computer, Generations of Computers, Classification of Computers, Computer Applications:
Computer as a system, basic concepts – hardware and software, functional units, and their interrelation. Block diagram showing Central Processing Unit, Memory, and Input/Output Devices. Communication devices.

SECTION–B (15 Hrs.)

Software: System software and Application software. Programming languages.
Hardware: Input Devices- Keyboard, mouse, pens, touch screens, Bar Code reader, joystick, source data automation, (MICR, OMR, OCR), screen assisted data entry: portable/handheld terminals for data collection, voice recognition systems
Output Devices: Display Monitors, Printers, Impact Printers, Non-impact Printers, Plotters, Voice Output Systems, Projectors, Terminals.
Storage Devices: Concept of storage units(bit, byte, KB, MB etc.), Primary storage, Secondary storage, Magnetic storage devices, and Optical Storage Devices.

SECTION–C (15 Hrs.)

Operating System: meaning, purpose, Windows GUI, Command-line, Powershell overview. File Explorer.
Microsoft (MS) Office: download and install; different components
Word Processing using Microsoft (MS) Word: Overview, creating, saving, opening, importing, exporting and inserting files, formatting pages, paragraphs and sections, indents and outdents, creating lists and numbering. headings, styles, fonts and font size; editing, positioning, and viewing texts; finding and replacing text; inserting page breaks, page numbers, bookmarks, symbols, and dates; using tables, header, footer, macros, mail-merge; printing setup

SECTION–D (15 Hrs.)

Presentations using MS Powerpoint: Presentation overview, entering information, presentation creation, opening and saving presentation; inserting audio and video, shapes, different views, formatting; playing slides. Spreadsheets using MS Excel: Spreadsheet overview, Editing, Formatting, freeze panes, using formulas and functions, sorting and filtering, pivot tables, charts and Graphs.

Recommended Books:

1. P.K. Sinha, Computer Fundamentals : concepts,systems and applications, BPB Publications
2. E Balagurusamy, FUNDAMENTALS OF COMPUTERS Tata McGraw Hill Education Private Limited NEW DELHI
3. Peter Norton, Introduction to Computers, McGraw Hill Education
4. MS–Office _ BPB Publications.
5. Gurvinder Singh & Rachpal Singh, Windows-Based Computer Courses.
6. Ebooks at OpenOffice.org
7. A Conceptual Guide to OpenOffice.org3, 2nd Edition, R. Gabriel Gurley

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SEMESTER-I

BCA01006L: Lab-1 based on Computer Fundamentals & PC Software

M. Marks: 25
Time: 3 Hours

Credits
L-T-P
0-0-1
(30Hrs)

Instructions for the examiners: -
Two questions of equal marks strictly as per the syllabus and based on the practical exercises covered in the semester. Questions may be subdivided into parts (not exceeding four). Candidates will attempt ONE question, explain their answer by writing on the answer sheet, and then implement the same on the computer. Examiner will evaluate both the answers (theory as well as practical). The viva should also be conducted alongside, and the student is asked viva questions related to the question and the solution he/she is working on during the exam.

Students will prepare a report after analyzing print and social media advertisements along with the local market survey to understand the desktop/laptop vendors and prices. Arrange the options available as per price/performance preferences

Lab exercises based on:

- Practice the Windows Operating System command-line and the GUI for user interaction, personalization, and file management
- Document preparation with Word using the features mentioned in the syllabus
- Spreadsheet processing with Excel using the features mentioned in the syllabus
- Presentation preparation with PowerPoint using the features mentioned in the syllabus

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SEMESTER -I

BCA01010T: Introduction to Programming using Python

M. Marks: 75
Time: 3 Hours

Credits
L-T-P
3-0-0
(60Hrs)

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 Outcomes:

- Understand the strengths of the Python language.
- Gain proficiency in string handling, functions, and n control flow statements.
- Create and manipulate Python programs by using different data structures and object-oriented concepts.
- Understand the operations involved in creating and manipulating file systems and databases.

SECTION–A (15 Hrs.)

Problem Solving, Problem Analysis, Concept of writing an algorithm, drawing a flowchart, developing a program.; Introduction to Python: Python's features, Story behind the name, Python versions, Execution environments: the Python Interpreter and IDEs (e.g. PyCharm or VSCode), Getting and Setting up Python.
Python program structure; writing your first "Hello World" program; creating, saving and executing a program; comments, Indentation.

SECTION–B (15 Hrs.)

Data and Expressions: Literal Constants, numbers, strings – immutable strings, quotes, the escape sequence, the format methos; Variables and Identifiers, data types, object, Operators & Expressions – short cuts, evaluation order, Boolean Expressions (Conditions), Logical Operators. User Input/output
Control Flow: Selection Control, Nested conditions, Loops, break and Continue Statements,
Data Structures: list, tuple, dictionary and set; basic operations e.g. creating, indexing, slicing, membership

SECTION–C (15 Hrs.)

Functions: defining and calling functions, passing and returning values, local and global variables, recursive functions, Iteration vs. Recursion
Modules: purpose and usage, the import statement, from – import statement, the __main__ attribute, creating a module and importing, the dir() function
Handling Exceptions – try..catch and with statements, errors, debugging

SECTION–D (15 Hrs.)

Files and Strings: Opening Files, Using Text Files, Reading files, Writing files, Understanding read functions, Understanding write functions
Introduction to numpy and pandas for data processing

Recommended Books and Materials:

1. Yashavant Kanetkar, Aditya Kanetkar, Let Us Python-6Th Edition, BPB Publications.
2. Charles Dierbach, Introduction to Computer Science Using Python: A Computational Problem-Solving Focus, Wiley Publications.
3. Martin C. Brown, Python: The Complete Reference, Indian Edition, McGraw Hill Education (India) Private Limited
4. Mark J. Guzdial, Introduction to Computing and Programming in Python, Pearson Education.
5. https://www.python.org/about/
6. Swaroop C.H.,A Byte of Python available at https://python.swaroopch.com/
7. https://checkio.org/
8. https://www.jetbrains.com/pycharm-edu/

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SEMESTER -I

BCA01011L: Lab-2 based on Introduction to Programming using Python.

M. Marks: 25
Credits
L-T-P
0-0-1
(30Hrs)

Time: 3 Hours

Instructions for the examiners: -
Two questions of equal marks strictly as per the syllabus and based on the practical exercises covered in the semester. Questions may be subdivided into parts (not exceeding four). Candidates will attempt ONE question, explain their answer by writing on the answer sheet, and then implement the same on the computer. Examiner will evaluate both the answers (theory as well as practical). The viva will also be conducted one-on-one alongside, and the student asked viva questions related to the question and the solution he/she is working on during the exam.

Programming exercises based on:

- Use the Python interactive interpreter
- Getting familiar with a Python IDE
- Python fundamentals, data types, operators
- Operators, flow control using if, else and elif, While statement, loops using For, Loop Patterns,
- Implementation of different collections like list, tuple and dictionary and their various functions,
- Demonstrating creation of functions, passing parameters and return values,
- Working with modules
- Handling Exceptions
- Implementation of reading, writing and organizing files
- Basic numpy and pandas functions

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SEMESTER-I

BCA01003T: Applied and Discrete Mathematics

M. Marks: 100
Time: 3 Hours

Credits
L-T-P
4-0-0
(60Hrs)

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

Sets and Relations: Definition of sets, subsets, complement of a set, universal set, intersection and union of sets, De-Morgan's laws, Cartesian products, Equivalent sets, Countable and uncountable sets, minset, Partitions of sets, Relations: Basic definitions, graphs of relations, properties of relations

SECTION–B

Logic and Propositional Calculus: Proposition and Compound Propositions, basic Logical Operations, Propositions and Truth Tables, Tautologies and Contradictions, Logical Equivalence, Duality law, Algebra of propositions, Conditional and Bi conditional Statements, Arguments, Logical Implication, Propositional Functions, Predicates and Quantifiers, Negation of Quantified Statements, Inference theory of the predicates calculus.

SECTION–C

Boolean Algebra: Boolean algebra and its duality, Duality, Boolean Algebra as Lattices, Boolean identities, sub-algebra, Representation Theorem, Sum-of-Products Form for Sets, Sum of-Products Form for Boolean Algebra, Minimal Boolean Expressions, Prime Implicants, Boolean Functions, Karnaugh Maps.

SECTION–D

Matrices: Introduction of a Matrix, its different kinds, matrix addition and scalar multiplication, multiplication of matrices, transpose etc. Square matrices, inverse of a square matrix, Matrix Inversion method, characteristics polynomial, eigen values, eigen vectors, Cayley–Hamilton theorem.

References:

1. Lipschutz, S. and Lipson, M.: Discrete Mathematics (Schaum's outlines Series).
2. Kolman and Busby "Discrete Mathematical structures for Computer Sciences" PHI.
3. Alan Doerr,"Applied Discrete Structures for Computer Science", Galgotia Publications.
4. Trambley, J.P. and Manohar,R: Discrete Mathematical Structures with Applications to Computer Science.

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SEMESTER-I

BCA01008T: Introduction to the Internet

(Theory)

(SEC-1)

M. Marks: 50
Time: 3 Hours

Credits
L-T-P
2-0-0
(30 Hrs)

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 Outcomes:
To give hands-on experience and provide a comprehensive, non-technical, hands-on overview of the Internet based services.

SECTION–A (7.5 Hrs)

Origin, growth and evolution of the Internet; the impact of the Internet; terminology: web pages, website, web browser, web server, bandwidth; Connect to the Internet: hardware and software, types of Internet connections, Internet Service Providers; Navigating different types of websites and online resources.

Student should explore the local market to understand the internet service providers, rates, bandwidth etc.

SECTION – B (7.5 Hrs)

Email Communication: Email Etiquette and Best Practices, Managing and Organizing Emails Email Tools and Features, identifying spam and phishing emails;

Searching on the Internet: Overview of internet resources and search engines, Basics of Using Search Engines - How search engines work, Basic search techniques and tips, Understanding search engine results pages (SERPs), Using search operators (e.g., AND, OR, NOT), Utilizing advanced search features (e.g., Google Advanced Search),

SECTION – C (7.5 Hrs)

Online Tools for Productivity: Introduction to productivity tools (e.g., Google Workspace, Microsoft Office 365), Cloud storage and file management (e.g., Google Drive, Dropbox),

Collaboration and Communication Tools: Online communication etiquette and best practices, using collaboration tools (e.g., Google Docs, Slack, Microsoft Teams), Effective virtual meeting strategies (e.g., Zoom, Google Meet),

SECTION – D (7.5 Hrs)

Building Online Presence: Creating and maintaining a professional online profile (e.g., LinkedIn), Personal branding and digital portfolios, Networking strategies for academic and career growth, Understanding digital footprints and online reputation.

Digital citizenship and respectful online behaviour, balancing screen time and managing digital distractions

Recommended Books and Materials:

1. Douglas E Comer, The Internet Book: Everything You Need to Know About Computer Networking and How the Internet Works, CRC Press
2. Faithe Wempen, Digital Literacy For Dummies 1st Edition

Bachelor of Computer Applications (Honours) (CBGS)
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SEMESTER-I

BCA01009L: Lab-3 based on Introduction to the Internet

(Practical)

(SEC-1)

M. Marks: 25

Credits
L-T-P
0-0-1
(30 Hrs)

Time: 3 Hours

Instructions for the examiners: -
Two questions of equal marks strictly as per the syllabus and based on the practical exercises covered in the semester. Questions may be subdivided into parts (not exceeding four). Candidates will attempt ONE question, explain their answer by writing on the answer sheet, and then implement the same on the computer. Examiner will evaluate both the answers (theory as well as practical). The viva should also be conducted alongside, and the student is asked viva questions related to the question and the solution he/she is working on during the exam.

Lab exercises based on:

- Identifying internet connections and Configuring internet connection on PC/Laptop
- Email Tools and features
- Using the Google search engine and explore Bing
- Using Google Docs, Google Drive for document preparation and storage
- Collaboration using Slack
- Analyzing LinkedIn profiles
- Creating your own LinkedIn profile
- Virtual meeting platforms: Microsoft Teams, Zoom, Google Meet

Bachelor of Computer Applications (Honours) (CBGS)
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SEMESTER–I

ENL121: COMMUNICATION SKILLS IN ENGLISH–I (THEORY)

Time: 3 Hours **Credits: 4-0-0**
(6 periods per week)
Max. Marks: 100

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

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SEMESTER–I
PBL601: PunjabI Compulsory-1
ਪੰਜਾਬੀ(ਲਾਜ਼ਮੀ)–1

ਕਰੈਡਿਟ 4–0–0

Time: 03 Hours **Max. Marks: 100**

(6 ਪੀਰੀਅਡ ਪ੍ਰਤੀ ਹਫ਼ਤਾ)

ਅੰਕ–ਵੰਡ ਅਤੇ ਪਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ

1. ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਚਾਰ ਭਾਗ ਹੋਣਗੇ। ਹਰ ਭਾਗ ਵਿਚ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ।
2. ਵਿਦਿਆਰਥੀ ਨੇ ਕੁੱਲ ਪੰਜ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਹਨ। ਹਰ ਭਾਗ ਵਿਚੋਂ ਇਕ ਪ੍ਰਸ਼ਨ ਲਾਜ਼ਮੀ ਹੈ। ਪੰਜਵਾਂ ਪ੍ਰਸ਼ਨ ਕਿਸੇ ਵੀ ਭਾਗ ਵਿਚੋਂ ਕੀਤਾ ਜਾ ਸਕਦਾ ਹੈ।
3. ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ ਅੰਕ ਬਰਾਬਰ ਹਨ।
4. ਪੇਪਰ ਸੈੱਟ ਕਰਨ ਵਾਲਾ ਜੇਕਰ ਚਾਹੇ ਤਾਂ ਪ੍ਰਸ਼ਨਾਂ ਦੀ ਵੰਡ ਅੱਗੋਂ ਵੱਧ ਤੋਂ ਵੱਧ ਚਾਰ ਉਪ-ਪ੍ਰਸ਼ਨਾਂ ਵਿਚ ਕਰ ਸਕਦਾ ਹੈ।

ਪਾਠ–ਕ੍ਰਮ

ਸੈਕਸ਼ਨ–ਏ

ਸਰਵੋਤਮ ਪੰਜਾਬੀ ਕਵਿਤਾ ਤੇ ਕਹਾਣੀ

(ਸੰਪਾ. ਡਾ. ਰਮਿੰਦਰ ਕੌਰ, ਡਾ. ਮੇਘਾ ਸਲਵਾਨ) ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ।
(ਕਵਿਤਾ ਭਾਗ)
(ਕਵਿਤਾ ਦੀ ਪ੍ਰਸੰਗ ਸਹਿਤ ਵਿਆਖਿਆ/ਵਿਸ਼ਾ–ਵਸਤੂ/ਸਾਰ)

ਸੈਕਸ਼ਨ–ਬੀ

ਮੰਚ ਘਰ

ਡਾ. ਕੁਲਦੀਪ ਸਿੰਘ ਧੀਰ, ਡਾ. ਹਿਰਦੇਜੀਤ ਸਿੰਘ ਭੋਗਲ (ਸੰਪਾ.), ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ।
(ਵਿਸ਼ਾ–ਵਸਤੂ, ਪਾਤਰ ਚਿਤਰਨ)

ਸੈਕਸ਼ਨ–ਸੀ

(ੳ) ਪੈਰ੍ਹਾ ਰਚਨਾ
(ਅ) ਪੈਰ੍ਹਾ ਪੜ੍ਹ ਕੇ ਪ੍ਰਸ਼ਨਾਂ ਦੇ ਉੱਤਰ

ਸੈਕਸ਼ਨ–ਡੀ

ਭਾਸ਼ਾ ਵੰਨਗੀਆਂ:

ਭਾਸ਼ਾ ਦਾ ਟਕਸਾਲੀ ਰੂਪ, ਭਾਸ਼ਾ ਅਤੇ ਉਪਭਾਸ਼ਾ ਵਿਚਲਾ ਅੰਤਰ, ਪੰਜਾਬੀ ਉਪਭਾਸ਼ਾਵਾਂ ਦੇ ਪਛਾਣ ਚਿੰਨ੍ਹ, ਪੰਜਾਬੀ ਭਾਸ਼ਾ–ਨਿਕਾਸ ਤੇ ਵਿਕਾਸ

ਸਹਾਇਕ ਪੁਸਤਕਾਂ

1. ਰਾਜਿੰਦਰਪਾਲ ਸਿੰਘ ਬਰਾੜ, **ਪੰਜਾਬੀ ਕਵਿਤਾ ਦਾ ਇਤਿਹਾਸ**, ਪੰਜਾਬੀ ਅਕਾਦਮੀ, ਦਿੱਲੀ।
2. ਬ੍ਰਹਮਜਗਦੀਸ਼ ਸਿੰਘ, **ਆਧੁਨਿਕ ਪੰਜਾਬੀ ਕਾਵਿ ਸਿਧਾਂਤ, ਇਤਿਹਾਸ ਅਤੇ ਪ੍ਰਵਿਰਤੀਆਂ**,ਵਾਰਿਸ ਸ਼ਾਹ ਫਾਉਂਡੇਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ।
3. ਬਲਦੇਵ ਸਿੰਘ ਧਾਲੀਵਾਲ, **ਪੰਜਾਬੀ ਕਹਾਣੀ ਦਾ ਇਤਿਹਾਸ**, ਪੰਜਾਬੀ ਅਕਾਦਮੀ, ਦਿੱਲੀ।
4. ਸਤਿੰਦਰ ਸਿੰਘ, **ਆਧੁਨਿਕ ਪੰਜਾਬੀ ਵਾਰਤਕ ਦਾ ਇਤਿਹਾਸ**, ਪੰਜਾਬੀ ਅਕਾਦਮੀ, ਦਿੱਲੀ।
5. ਡਾ.ਰਮਿੰਦਰ ਕੌਰ, **ਪੰਜਾਬੀ ਕਹਾਣੀ ਦਾ ਸਫ਼ਰ ਤੇ ਸ਼ਾਸਤ੍ਰ ਭਾਗ–I**, ਸਿੰਘ ਬ੍ਰਦਰਜ਼, ਅੰਮ੍ਰਿਤਸਰ।
6. ਹਰਕੀਰਤ ਸਿੰਘ, **ਭਾਸ਼ਾ ਤੇ ਭਾਸ਼ਾ ਵਿਗਿਆਨ**, ਲਾਹੌਰ ਬੁੱਕ ਸ਼ਾਪ, ਲੁਧਿਆਣਾ।
7. ਹਰਕੀਰਤ ਸਿੰਘ ਤੇ ਗਿਆਨੀ ਲਾਲ ਸਿੰਘ, **ਕਾਲਜ ਪੰਜਾਬੀ ਵਿਆਕਰਣ**, ਪੰਜਾਬ ਯੂਨੀਵਰਸਿਟੀ, ਚੰਡੀਗੜ੍ਹ।
8. ਬੂਟਾ ਸਿੰਘ ਬਰਾੜ, **ਪੰਜਾਬੀ ਵਿਆਕਰਨ : ਸਿਧਾਂਤ ਤੇ ਵਿਹਾਰ**, ਚੇਤਨਾ ਪ੍ਰਕਾਸ਼ਨ, ਲੁਧਿਆਣਾ।
9. ਮਿੰਨੀ ਸਲਵਾਨ, **ਪੰਜਾਬੀ ਵਿਆਕਰਨ : ਮੁੱਢਲੇ ਸੰਕਲਪ**, ਰਵੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ
10. **ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਬੋਧ**, ਕਸਤੂਰੀ ਲਾਲ ਐਂਡ ਸੰਨਜ਼, ਅੰਮ੍ਰਿਤਸਰ।

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SEMESTER–I

PBL611: ਮੁੱਢਲੀ ਪੰਜਾਬੀ-1
(In lieu of Compulsory Punjabi)

ਕਰੈਡਿਟ 4–0–0

Time: 03 Hours **Max. Marks: 100**

(6 ਪੀਰੀਅਡ ਪ੍ਰਤੀ ਹਫ਼ਤਾ)

ਅੰਕ–ਵੰਡ ਅਤੇ ਪਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ

1. ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਚਾਰ ਭਾਗ ਹੋਣਗੇ। ਹਰ ਭਾਗ ਵਿਚ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ।
2. ਵਿਦਿਆਰਥੀ ਨੇ ਕੁੱਲ ਪੰਜ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਹਨ। ਹਰ ਭਾਗ ਵਿਚੋਂ ਇਕ ਪ੍ਰਸ਼ਨ ਲਾਜਮੀ ਹੈ। ਪੰਜਵਾਂ ਪ੍ਰਸ਼ਨ ਕਿਸੇ ਵੀ ਭਾਗ ਵਿਚੋਂ ਕੀਤਾ ਜਾ ਸਕਦਾ ਹੈ।
3. ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ ਬਰਾਬਰ ਅੰਕ ਹਨ।
4. ਪੇਪਰ ਸੈੱਟ ਕਰਨ ਵਾਲਾ ਜੇਕਰ ਚਾਹੇ ਤਾਂ ਪ੍ਰਸ਼ਨਾਂ ਦੀ ਵੰਡ ਅੱਗੋਂ ਵੱਧ ਤੋਂ ਵੱਧ ਚਾਰ ਉਪ-ਪ੍ਰਸ਼ਨਾਂ ਵਿੱਚ ਕਰ ਸਕਦਾ ਹੈ।

ਪਾਠ–ਕ੍ਰਮ

ਸੈਕਸ਼ਨ–ਏ

ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਤੇ ਗੁਰਮੁਖੀ ਲਿਪੀ

(ੳ) ਨਾਮਕਰਣ ਤੇ ਸੰਖੇਪ ਜਾਣ-ਪਛਾਣ : ਗੁਰਮੁਖੀ ਵਰਣਮਾਲਾ, ਅਖਰ ਕ੍ਰਮ, ਸਵਰ ਵਾਹਕ (ੳ ਅ ੲ), ਲਗਾਂ-ਮਾਤਰਾਂ, ਪੈਰ ਵਿਚ ਬਿੰਦੀ ਵਾਲੇ ਵਰਣ, ਪੈਰ ਵਿਚ ਪੈਣ ਵਾਲੇ ਵਰਣ, ਬਿੰਦੀ, ਟਿਪੀ, ਅਧਕ।

(ਅ) ਸਿਖਲਾਈ ਤੇ ਅਭਿਆਸ

ਸੈਕਸ਼ਨ–ਬੀ

ਗੁਰਮੁਖੀ ਆਰਥੋਗ੍ਰਾਫੀ ਅਤੇ ਉਚਾਰਨ : ਸਵਰ, ਵਿਅੰਜਨ : ਮੁਢਲੀ ਜਾਣ-ਪਛਾਣ ਅਤੇ ਉਚਾਰਣ, ਮੁਹਾਰਨੀ, ਲਗਾਂ–ਮਾਤਰਾਂ ਦੀ ਪਛਾਣ।

ਸੈਕਸ਼ਨ–ਸੀ

ਪੰਜਾਬੀ ਸ਼ਬਦ ਜੋੜ : ਮੁਕਤਾ (ਦੋ ਅਖਰਾਂ ਵਾਲੇ ਸ਼ਬਦ, ਤਿੰਨ ਅਖਰਾਂ ਵਾਲੇ ਸ਼ਬਦ), ਸਿਹਾਰੀ ਵਾਲੇ ਸ਼ਬਦ, ਬਿਹਾਰੀ ਵਾਲੇ ਸ਼ਬਦ, ਔਂਕੜ ਵਾਲੇ ਸ਼ਬਦ, ਦੁਲੈਂਕੜ ਵਾਲੇ ਸ਼ਬਦ, ਲਾਂ ਵਾਲੇ ਸ਼ਬਦ, ਦੁਲਾਵਾਂ ਵਾਲੇ ਸ਼ਬਦ, ਹੋੜੇ ਵਾਲੇ ਸ਼ਬਦ, ਕਨੌੜੇ ਵਾਲੇ ਸ਼ਬਦ।

ਸੈਕਸ਼ਨ–ਡੀ

ਲਗਾਖ਼ਰ (ਬਿੰਦੀ, ਟਿਪੀ, ਅਧਕ ਵਾਲੇ ਸ਼ਬਦ)
ਸ਼ੁਧ, ਅਸ਼ੁਧ (ਪੈਰ੍ਹੇ ਵਿਚ ਲਿਖੇ ਅਸ਼ੁਧ ਸ਼ਬਦਾਂ ਨੂੰ ਸ਼ੁਧ ਕਰਨਾ)

ਸਹਾਇਕ ਪੁਸਤਕਾਂ

1. ਬ੍ਰਹਮਜਗਦੀਸ਼ ਸਿੰਘ, **ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਅਤੇ ਗੁਰਮੁਖੀ ਲਿਪੀ**, ਵਾਰਿਸ ਸ਼ਾਹ ਫਾਉਂਡੇਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ।
2. ਪ੍ਰੋ. ਸ਼ੈਰੀ ਸਿੰਘ, ਪ੍ਰੋ. ਬ੍ਰਹਮਜਗਦੀਸ਼ ਸਿੰਘ, **ਭਾਸ਼ਾ ਵਿਗਿਆਨ : ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਤੇ ਗੁਰਮੁਖੀ ਲਿਪੀ**, ਵਾਰਿਸ ਸ਼ਾਹ ਫਾਉਂਡੇਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ।
3. **ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਬੋਧ**, ਕਸਤੂਰੀ ਲਾਲ ਐਂਡ ਸੰਨਜ਼, ਅੰਮ੍ਰਿਤਸਰ।
4. ਮਿੰਨੀ ਸਲਵਾਨ, **ਪੰਜਾਬੀ ਵਿਆਕਰਨ : ਮੁਢਲੇ ਸੰਕਲਪ**, ਰਵੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ।

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SEMESTER – I

PHC110-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)

Credits
L T P
4 00

Time: 3 Hours
Max. Marks: 100

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: Origin and extent Town planning; social, economic and religious life of the Indus Valley People.
4. The Indo-Aryans: Original home and settlements in Punjab.

SECTION-C

5. Social, Religious and Economic life during *Rig* Vedic Age.
6. Social, Religious and Economic life during Later Vedic Age.

SECTION-D

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

Suggested Readings:

1. L. M Joshi (ed.), *History and Culture of the Punjab*, Art-I, Patiala, 1989 (3rd edition)
2. L.M. Joshi and Fauja Singh (ed.), *History of Punjab*, Vol.I, Patiala 1977.
3. BudhaParkash, *Glimpses of Ancient Punjab*, Patiala, 1983.
4. B.N. Sharma, *Life in Northern India*, Delhi. 1966.
5. Chopra, P.N., Puri, B.N., & Das, M.N.(1974). *A Social, Cultural & Economic History of India,* Vol. I, New Delhi: Macmillan India.

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SEMESTER-II

Introduction to C Programming

M. Marks: 75 **Credits**
Time: 3 Hours **L-T-P**
3-0-0

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.

CourseOutcomes:

- Understand and use program development life cycle and canemploy various tools for it.
- Develop the program logic to solve simple and complex problems.
- Use various programming constructs of Clike branching, looping and arrays.
- Deploy the pointers for memory management.

SECTION–A

Introduction :-Introduction to Computer Programming, concept of algorithm, flowchart, program structure, Program Development lifecycle - Compiling and executing programs using IDE, command line

Fundamentals: Token, Character set, Identifiers and Key Words, Constants, Variables, Expressions, Statements, Symbolic Constants; Data types, declaring variables, initializing variables, types of integers, types of floats, strings, characters

C Preprocessor directives: #define Statement, Conditional Compilation, include Files, typedef,enum, Type Casting

Operations and Expressions: Arithmetic operators, Unary operators, Relational Operators, Logical Operators, Assignment and Conditional Operators

Data Input and Output statements, Library functions

SECTION–B

Control Statements: Preliminaries, While, Do–while and For statements, Nested loops, If–else, Switch, Break – Continue statements.

Program Structure Storage Class: Automatic, external and static variables, multiple file programs.

Arrays: Defining, processing an array, passing arrays to a function, multi–dimensional arrays

Strings: String declaration, string functions and string manipulation.

SECTION–C

Functions: Brief overview, defining, accessing functions, passing arguments to function, variable scope, specifying argument data types, function prototypes, recursion.

Pointers: Fundamentals, pointer declaration, passing pointer to a function, pointer and one-dimensional arrays, operation on pointers, pointers & multi–dimensional arrays of pointers, passing functions, dynamic memory management.

SECTION–D

Structures & Unions: Defining and processing a structure, user defined data types, structures and pointers, passing structures to functions, self-referenced structure, unions, Arrays and Structures,

File handling in C:-Introduction, file input/output function, binary file and text file.

References:

1. Yashvant Kanetkar, Let UsC, BPB Publications, Delhi.
2. ByronGotterfied,ProgramminginC,TataMcGrawHillPublishingCompanyLtd.,Delhi.
3. Dennis Ritchie, Brian Kernighan, C Programming Language, Prentice Hall India
4. R.S.Salaria,ApplicationsProgramminginC,KhannaBookPublishingCo.(P)Ltd.,Delhi.

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SEMESTER–II

Lab-1 based on Introduction to C Programming

M. Marks: 25 **Credits**
Time: 3 Hours **L-T-P**
0-0-1
(2h/week)

Instructions for the examiners: -
Two questions of equal marks strictly as per the syllabus and based on the practical exercises covered in the semester. Questions may be subdivided into parts (not exceeding four). Candidates will attempt ONE question, explain their answer by writing on the answer sheet, and then implement the same on the computer. Examiner will evaluate both the answers (theory as well as practical). The viva will also be conducted one-on-one alongside, and the student asked viva questions related to the question and the solution he/she is working on during the exam.

Programming exercises based on:

1. Compiling and executing programs using command line
2. Set up the IDE
3. Declaring variables of different data types and practice type casting
4. Using typedef, enum
5. Using c pre-processor directives, conditional compilation
6. Operators and conditional statements
7. Control statements
8. Storage classes
9. Concept of arrays, strings
10. Functions
11. Pointers
12. Structures and Unions
13. File handling

Bachelor of Computer Applications (Honours) (CBGS)
Syllabus for the Batch from Year 2025 to Year 2029

SEMESTER–II

Principles of Digital Electronics

M. Marks: 100
Time: 3 Hours

Credits
L-T-P
4-0-0
(60Hrs)

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 Outcomes:

1. Explain number systems, basic logic gates, Boolean algebra and define characteristics of logic families.
2. Illustrate the working mechanism and design guidelines of different combinational circuits in the digital system.
3. Analyze the working mechanism and design guidelines of different sequential circuits.
4. Assess the nomenclature and technology in the area of memory devices and apply the memory devices in different types of digital circuits.

SECTION–A (15 Hrs)

Number System: Data Types, Number Systems and Conversion, Complements, Fixed Point Representation, Floating Point Representation, Error Detection Codes, Computer Arithmetic - Addition, Subtraction, Multiplication and Division Algorithms.

SECTION–B (15 Hrs.)

Logic Gates and Boolean Algebra: Logic gates, Universal Gates, Boolean algebra and Minimization techniques, canonical forms of Boolean expressions, Karnaugh-Maps, don't care conditions

SECTION–C (15 Hrs.)

Combinational Circuits: Adder, Subtracter, Multiplexer, Demultiplexer, Decoder, Encoder
Sequential Circuits: Flip-flops, clocks and timers, registers, counters

SECTION–D (15 Hrs.)

Semiconductor memories: Introduction, Static and dynamic devices, read only & random access memory chips, PROMS and EPROMS Address selection logic. Read and write control timing diagrams for ICs

Recommended Books and Materials:

1. Morris Mano and Michael D. Ciletti, Digital Logic and Computer Design, Pearson India, 2013.
2. Albert Malvino, Jerald Brown, Digital Computer Electronics, McGraw HillMcGraw Hill Education, 2017
3. John Ujjenbeck, Digital Electronics: A Modern Approach, Prentice Hall, 1994.

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SEMESTER -II

Numerical Methods & Statistical Techniques

M. Marks: 100
Time: 3 Hours

Credits
L-T-P
4-0-0
(60Hrs)

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 must attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Please also note that greater weightage is to be given to exercises rather than theoretical derivation of all numerical and statistical methods.
Other notes: Only non–programmable & non–storage-type calculators are allowed in the exam.

SECTION–A (15 Hrs)

Introduction Numerical Methods, Numerical methods versus numerical analysis, Errors and Measures of Errors. Non-linear Equations, Iterative Solutions, Multiple roots and other difficulties, Interpolation methods. Bi-section Method, False position method, Newton Raphson-method, Simultaneous solution of equations, Gauss Elimination Method Gauss Jordan Method, Gauss Seidel Method.

SECTION–B (15 Hrs)

Interpolation and Curve Fitting, Lagrangian Polynomials, Newton's Method: Forward Difference Method, Backward Difference Method, Divided Difference Method, Numerical Integration and Different Trapezoidal Rule, Simpson's 1/3 Rule, Simpson's 3/8 Rule.

SECTION–C (15 Hrs)

Probability and Statistics: Mathematical and statistical probability, axiomatic approach to probability, law of addition of probability, dependence of events, Baye's theorem Normal distribution.

SECTION-D (15 Hrs)

Statistical Techniques: Measure of Central Tendency, Mean Arithmetic, Mean geometric, Mean harmonic, Mean, Median, Mode, Measures of dispersion, Mean deviation, Standard deviation, coefficient of variation, Correlation, lines of regression.

Recommended books:

1. R.S. Salaria: Computer Oriented Numerical Methods, Khanna Publishing Company (P) Ltd., New Delhi.

2. V. Rajaraman: Computer Oriented Numerical Methods, Prentice Hall of India Pvt. Ltd., New Delhi.

3. S.C. Gupta, V.K. Kapoor, Fundamentals of Mathematical Statistics.

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SEMESTER-II

SOA-105 DRUG ABUSE: PROBLEM, MANAGEMENT AND PREVENTION
(VALUE ADDED COURSE)

Time: 3 Hours **Credits**
Max. Marks: 50 **L T P**
2 0 0

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:

1) Meaning, Nature and Extent of Drug Abuse in India and Punjab.

2) Consequences of Drug Abuse for:

Individual	:	Education, Employment, Income.
Family	:	Violence.
Society	:	Crime.
Nation	:	Law and Order problem.

SECTION – B

Management of Drug Abuse:

(i) Medical Management: Medication for treatment and to reduce withdrawal effects.
(ii) Psychiatric Management: Counselling, Behavioural and Cognitive therapy.
(iii) Social Management: Family, Group therapy and Environmental Intervention, Rehabilitation.

SECTION – C

Prevention of Drug abuse:

(i) Role of family: Parent child relationship, Family support, Supervision, Shaping values, Active Scrutiny.
(ii) School: Counselling, Teacher as role-model. Parent-teacher-Health Professional Coordination, Random testing on students.

SECTION – D

Controlling Drug Abuse:

(i) Media: Restraint on advertisements of drugs, advertisements on bad effects of drugs, Publicity and media, Campaigns against drug abuse, Educational and awareness program
(ii) Legislation: NDPs act, Statutory warnings, Policing of Borders, Checking Supply/Smuggling of Drugs, Strict enforcement of laws, Time bound trials.

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 Empowerment, Government of India, 2004.
3. Inciardi, J.A. 1981. *The Drug Crime Connection.* Beverly Hills: Sage Publications.
4. Kapoor. T. (1985) *Drug epidemic among Indian Youth*, New Delhi: Mittal Pub.
5. Kessel, Neil and Henry Walton. 1982, *Alcohalism. Harmond Worth:* Penguin Books.
6. Modi, Ishwar and Modi, Shalini (1997) *Drugs: Addiction and Prevention*, Jaipur: Rawat Publication.
7. National Household Survey of Alcohol and Drug abuse. (2003) New Delhi, Clinical 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.
9. Sain, Bhim 1991, *Drug Addiction Alcoholism,* Smoking obscenity New Delhi: Mittal Publications.
10. Sandhu, Ranvinder Singh, 2009, *Drug Addiction in Punjab*: A Sociological Study. Amritsar: Guru Nanak Dev University.
11. Singh, Chandra Paul 2000. *Alcohol and Dependence among Industrial Workers*: Delhi: Shipra.
12. Sussman, S and Ames, S.L. (2008). *Drug Abuse: Concepts, Prevention and Cessation,* Cambridge University Press.
13. Verma, P.S. 2017, "*Punjab's Drug Problem: Contours and Characterstics",* Economic and Political Weekly, Vol. LII, No. 3, P.P. 40-43.
14. World Drug Report 2016, United Nations office of Drug and Crime.
15. World Drug Report 2017, United Nations office of Drug and Crime.

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SEMESTER–II
ENL122 : COMMUNICATION SKILLS IN ENGLISH – II
(THEORY)

Time: 3 Hours

Credits: 3-0-0
(6 periods per week)
Max. Marks: 100
Theory Marks: 75
Practical Marks: 25

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

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SEMESTER–II

ENP122 : COMMUNICATION SKILLS IN ENGLISH – II

PRACTICAL / ORAL TESTING

Credits: 0-0-1

Marks: 25

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.

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SEMESTER–II
PBL602:Punjabi (Compulsory)-2
ਪੰਜਾਬੀ (ਲਾਜ਼ਮੀ)-2

ਕਰੈਡਿਟ 4–0–0
Time: 03 Hours **Max. Marks: 100**
(6 ਪੀਰੀਅਡ ਪ੍ਰਤੀ ਹਫ਼ਤਾ)

ਅੰਕ–ਵੰਡ ਅਤੇ ਪਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ

1. ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਚਾਰ ਭਾਗ ਹੋਣਗੇ। ਹਰ ਭਾਗ ਵਿਚ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ।
2. ਵਿਦਿਆਰਥੀ ਨੇ ਕੁੱਲ ਪੰਜ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਹਨ। ਹਰ ਭਾਗ ਵਿਚੋਂ ਇਕ ਪ੍ਰਸ਼ਨ ਲਾਜ਼ਮੀ ਹੈ। ਪੰਜਵਾਂ ਪ੍ਰਸ਼ਨ ਕਿਸੇ ਵੀ ਭਾਗ ਵਿਚੋਂ ਕੀਤਾ ਜਾ ਸਕਦਾ ਹੈ।
3. ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ ਅੰਕ ਬਰਾਬਰ ਹਨ।
4. ਪੇਪਰ ਸੈੱਟ ਕਰਨ ਵਾਲਾ ਜੇਕਰ ਚਾਹੇ ਤਾਂ ਪ੍ਰਸ਼ਨਾਂ ਦੀ ਵੰਡ ਅੱਗੋਂ ਵੱਧ ਤੋਂ ਵੱਧ ਚਾਰ ਉਪ-ਪ੍ਰਸ਼ਨਾਂ ਵਿਚ ਕਰ ਸਕਦਾ ਹੈ।

ਪਾਠ–ਕ੍ਰਮ

ਸੈਕਸ਼ਨ–ਏ

I. **ਸਰਵੋਤਮ ਪੰਜਾਬੀ ਕਵਿਤਾ ਤੇ ਕਹਾਣੀ**
(ਸੰਪਾ. ਡਾ. ਰਮਿੰਦਰ ਕੌਰ, ਡਾ. ਮੇਘਾ ਸਲਵਾਨ)
ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ।
(ਕਹਾਣੀ ਭਾਗ)
ਕਹਾਣੀ ਦਾ ਸਾਰ/ਵਿਸ਼ਾ–ਵਸਤੂ

ਸੈਕਸ਼ਨ–ਬੀ

ਗੰਦ ਪ੍ਰਵਾਹ (ਰੇਖਾ ਚਿੱਤਰ ਤੇ ਹਲਕੇ ਲੇਖ)
(ਸੰਪਾ. ਡਾ. ਬਿਕਰਮ ਸਿੰਘ ਘੁੰਮਣ ਅਤੇ ਜਸਪਾਲ ਸਿੰਘ),
ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ।
(ਵਿਸ਼ਾ–ਵਸਤੂ/ਸਾਰ/ਵਾਰਤਕ ਸ਼ੈਲੀ)

ਸੈਕਸ਼ਨ–ਸੀ

(ੳ) ਸ਼ਬਦ ਬਣਤਰ ਅਤੇ ਸ਼ਬਦ ਰਚਨਾ, ਪਰਿਭਾਸ਼ਾ, ਮੁਢਲੇ ਸੰਕਲਪ
(ਅ) ਸ਼ਬਦ ਸ਼੍ਰੇਣੀਆਂ

ਸੈਕਸ਼ਨ–ਡੀ

ਦਫ਼ਤਰੀ ਚਿੱਠੀ ਪੱਤਰ
ਮੁਹਾਵਰੇ ਅਤੇ ਅਖਾਣ

ਸਹਾਇਕ ਪੁਸਤਕਾਂ

1. ਸਤਿੰਦਰ ਸਿੰਘ, **ਆਧੁਨਿਕ ਪੰਜਾਬੀ ਵਾਰਤਕ ਦਾ ਇਤਿਹਾਸ**, ਪੰਜਾਬੀ ਅਕਾਦਮੀ, ਦਿੱਲੀ।
2. ਪ੍ਰੋ. ਪਿਆਰਾ ਸਿੰਘ, **ਪੰਜਾਬੀ ਵਾਰਤਕ : ਸਿਧਾਂਤ ਇਤਿਹਾਸ ਪ੍ਰਵਿਰਤੀਆਂ**, ਨਿਊ ਬੁੱਕ ਕੰਪਨੀ, ਜਲੰਧਰ।
3. ਇੰਦਰਪ੍ਰੀਤ ਸਿੰਘ ਧਾਮੀ, **ਪੰਜਾਬੀ ਰੇਖਾ ਚਿਤਰ : ਰੂਪ ਤੇ ਪ੍ਰਕਾਰਜ**, ਰਵੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ।
4. ਬਲਬੀਰ ਸਿੰਘ ਦਿਲ, **ਪੰਜਾਬੀ ਨਿਬੰਧ : ਸਰੂਪ, ਸਿੱਧਾਂਤ ਅਤੇ ਵਿਕਾਸ**, ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ।
5. ਹਰਕੀਰਤ ਸਿੰਘ ਤੇ ਗਿਆਨੀ ਲਾਲ ਸਿੰਘ, **ਕਾਲਜ ਪੰਜਾਬੀ ਵਿਆਕਰਨ**, ਪੰਜਾਬ ਯੂਨੀਵਰਸਿਟੀ, ਚੰਡੀਗੜ੍ਹ।
6. ਡਾ. ਅਮਰ ਕੋਮਲ (ਸੰਪਾ.), **ਚੋਣਵੇਂ ਪੰਜਾਬੀ ਨਿਬੰਧ** (ਭੂਮਿਕਾ), ਨੈਸ਼ਨਲ ਬੁੱਕ ਟਰੱਸਟ, ਇੰਡੀਆ।
7. ਅਬਨਾਸ਼ ਕੌਰ, **ਪੰਜਾਬੀ ਰੇਖਾ ਚਿੱਤਰ**, ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ।
8. ਮਿੰਨੀ ਸਲਵਾਨ, **ਪੰਜਾਬੀ ਵਿਆਕਰਨ : ਮੁੱਢਲੇ ਸੰਕਲਪ**, ਰਵੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ।
9. ਬੂਟਾ ਸਿੰਘ ਬਰਾੜ, **ਪੰਜਾਬੀ ਵਿਆਕਰਨ : ਸਿਧਾਂਤ ਤੇ ਵਿਹਾਰ**, ਚੇਤਨਾ ਪ੍ਰਕਾਸ਼ਨ, ਲੁਧਿਆਣਾ।

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SEMESTER - II

PBL612:ਮੁੱਢਲੀ ਪੰਜਾਬੀ-2
(In lieu of Compulsory Punjabi)

Time: 03 Hours **Max. Marks : 100**

ਕਰੈਡਿਟ 4-0-0
(6 ਪੀਰੀਅਡ ਪ੍ਰਤੀ ਹਫ਼ਤਾ)

ਅੰਕ-ਵੰਡ ਅਤੇ ਪਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ

1. ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਚਾਰ ਭਾਗ ਹੋਣਗੇ। ਹਰ ਭਾਗ ਵਿਚ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ।
2. ਵਿਦਿਆਰਥੀ ਨੇ ਕੁੱਲ ਪੰਜ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਹਨ। ਹਰ ਭਾਗ ਵਿਚੋਂ ਇਕ ਪ੍ਰਸ਼ਨ ਲਾਜਮੀ ਹੈ। ਪੰਜਵਾਂ ਪ੍ਰਸ਼ਨ ਕਿਸੇ ਵੀ ਭਾਗ ਵਿਚੋਂ ਕੀਤਾ ਜਾ ਸਕਦਾ ਹੈ।
3. ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ ਬਰਾਬਰ ਅੰਕ ਹਨ।
4. ਪੇਪਰ ਸੈੱਟ ਕਰਨ ਵਾਲਾ ਜੇਕਰ ਚਾਹੇ ਤਾਂ ਪ੍ਰਸ਼ਨਾਂ ਦੀ ਵੰਡ ਅੱਗੋਂ ਵੱਧ ਤੋਂ ਵੱਧ ਚਾਰ ਉਪ-ਪ੍ਰਸ਼ਨਾਂ ਵਿੱਚ ਕਰ ਸਕਦਾ ਹੈ।

ਪਾਠ-ਕ੍ਰਮ

ਸੈਕਸ਼ਨ-ਏ

ਪੰਜਾਬੀ ਸ਼ਬਦ ਬਣਤਰ : ਧਾਤੂ, ਵਧੇਤਰ (ਅਗੇਤਰ, ਮਧੇਤਰ, ਪਿਛੇਤਰ), ਪੰਜਾਬੀ ਕੋਸ਼ਗਤ ਸ਼ਬਦ ਅਤੇ ਵਿਆਕਰਣਿਕ ਸ਼ਬਦ

ਸੈਕਸ਼ਨ-ਬੀ

(ੳ) ਸੰਯੁਕਤ ਸ਼ਬਦ, ਸਮਾਸੀ ਸ਼ਬਦ, ਦੋਜਾਤੀ ਸ਼ਬਦ, ਦੋਹਰੇ/ਦੁਹਰੁਕਤੀ ਸ਼ਬਦ ਅਤੇ ਮਿਸ਼ਰਤ ਸ਼ਬਦ
(ਅ) ਸਿਖਲਾਈ ਤੇ ਅਭਿਆਸ

ਸੈਕਸ਼ਨ-ਸੀ

ਇਕ-ਵਚਨ, ਬਹੁ-ਵਚਨ, ਲਿੰਗ-ਪੁਲਿੰਗ, ਬਹੁ-ਅਰਥਕ ਸ਼ਬਦ, ਸਮਾਨ-ਅਰਥਕ ਸ਼ਬਦ, ਬਹੁਤੇ ਸ਼ਬਦਾਂ ਲਈ ਇਕ ਸ਼ਬਦ, ਸ਼ਬਦ ਜੋੜ, ਵਿਰੋਧਆਰਥਕ ਸ਼ਬਦ।

ਸੈਕਸ਼ਨ-ਡੀ

ਨਿਤ ਵਰਤੋਂ ਦੀ ਪੰਜਾਬੀ ਸ਼ਬਦਾਵਲੀ: ਖਾਣ-ਪੀਣ, ਸਾਕਾਦਾਰੀ, ਰੁਤਾਂ, ਮਹੀਨਿਆਂ, ਗਿਣਤੀ, ਮੌਸਮ, ਮਾਰਕੀਟ/ਬਾਜ਼ਾਰ, ਵਪਾਰ, ਧੰਦਿਆਂ ਆਦਿ ਨਾਲ ਸੰਬੰਧਿਤ।

ਸਹਾਇਕ ਪੁਸਤਕਾਂ

1. ਜੋਤੀ ਸ਼ਰਮਾ, **ਪੰਜਾਬੀ ਵਿਆਕਰਨ**, ਵਾਰਿਸ ਸ਼ਾਹ ਫਾਉਂਡੇਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ।
2. **ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਬੋਧ**, ਕਸਤੂਰੀ ਲਾਲ ਐਂਡ ਸੰਨਜ਼, ਅੰਮ੍ਰਿਤਸਰ।
3. ਮਿੰਨੀ ਸਲਵਾਨ, **ਪੰਜਾਬੀ ਵਿਆਕਰਨ : ਮੁਢਲੇ ਸੰਕਲਪ**, ਰਵੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ।
4. ਰੰਜੂ ਬਾਲਾ, **ਅਰਥ ਵਿਗਿਆਨ**, ਆਰਸੀ ਪਬਲਿਸ਼ਰਜ਼, ਦਿਲੀ।
5. ਰੰਜੂ ਬਾਲਾ, **ਅਰਥ ਵਿਗਿਆਨ**, ਆਰਸੀ ਪਬਲਿਸ਼ਰਜ਼, ਦਿਲੀ।

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SEMESTER–II

PHC111:Punjab History & Culture (C. 320 to 1000 A.D.)
(Special Paper in lieu of Punjabi compulsory)
(For those students who are not domicile of Punjab)

Time: 3 Hours **Credits : 4-0-0**

Max. Marks: 100

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 century 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)
2. L.M. Joshi and Fauja Singh (ed.), *History of Punjab* , Vol.I, Punjabi University, Patiala, 1977.
3. BudhaParkash, *Glimpses of Ancient Punjab*, Patiala, 1983.
4. B.N. Sharma: *Life in Northern India*, Delhi. 1966.

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SEMESTER–III

SEMESTER–III

Data Structures & File Processing

M. Marks: 75 **Credits**
Time: 3 Hours **L-T-P**
3-0-0

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 outcome:
- To understand the abstract data types tack, queue, and list.
- Tounderstandtheperformanceoftheimplementationsofbasiclineardatastructures.
- To understand prefix, infix, and postfix expression formats
- To be able to implement the abstract data type list as a linked list using the node and reference pattern.
- To understand and implement trees and graph data structures

SECTION–A

Basic Data Structures: Introduction to elementary Data Organization and its operations, complexity of Algorithms – Big O-Notation, and Times pace trade off, Sparse Matrix, Arrays and its applications,
Searching Techniques: Linear and Binary Search
Stack and its applications – postfix notation, expression evaluation, recursion

SECTION–B

Linked Lists: Implementation of linked list, singly and doubly linked list, linked list operations with algorithms
Queues: Description of queue structure, implementation of queue using arrays and linked lists, description of priorities queue, Applications of queues.

SECTION–C

Trees: Description of tree structure and its terminology, binary search tree, AVL Trees, Threaded Binary Trees, B–Trees, B+trees.
Graphs: Description of graph structure, implementing graphs in memory using adjacency matrix oradjacency lists, various graphs traversing algorithms, finding shortest path between two nodes.

SECTION–D

Sorting Technique: Bubble Sort, selection sort, insertion sort, quick sort, merge sort, heapsort
File Organization: Concept of field, record, file, blocking and compaction.
File Organization Techniques: Sequential indexed, indexed sequential, Direct, Hashing, Concept of master and transaction files.

Reference Books:

1. SeymourLipschutz,DataStructure–SchaumOutlineSeries.
2. E Balaguruswamy, Data Structures using C, McGraw Hill Education
3. Yashwant Kanetker, Data Structures through C, BPB Publications
4. Trambley&Sorenson, DataStructures
5. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, Introduction to Algorithms
6. Mark Allen Weiss, Data Structures and Algorithm Analysis in C
7. Robert Sedgewick, Algorithms in C, Parts 1-4: Fundamentals, Data Structures, Sorting, Searching

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SEMESTER–III
Lab-1 based on Data Structures & File Processing

M. Marks: 25 **Credits**
Time: 3 Hours **L-T-P**
0-0-1
(2h/week)

Instructions for the examiners: -
Two questions of equal marks strictly as per the syllabus and based on the practical exercises covered in the semester. Questions may be subdivided into parts (not exceeding four). Candidates will attempt ONE question, explain their answer by writing on the answer sheet, and then implement the same on the computer. Examiner will evaluate both the answers (theory as well as practical). The viva will also be conducted one-on-one alongside, and the student asked viva questions related to the question and the solution he/she is working on during the exam.

Lab Exercises based on Implementation of Data Structures using the C language:

1. Arrays,
2. Searching(binary search, linear search)
3. Strings,
4. Linked list
5. Stacks (Using Arrays, linked lists)
6. Queues (Using Arrays, linked lists)
7. Trees – Traverse the BST, AVL Trees and B tree.
8. Sorting(selection sort, insertion sort, quick sort, merge sort, heap sort, bubble sort) ,
9. Graph-transversal, finding the shortest path
10. Handling the File structure

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SEMESTER -II

Computer Architecture

M. Marks: 100 **Credits**
Time: 3 Hours **L-T-P**
4-0-0
(60Hrs)

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

Information Representation : Register Transfer Language, Various Registers, Implementing Common Bus Using Multiplexers: Logical; Arithmetic & Shift Micro – operations.

Basic Computer Design Instruction Codes, Computer Instructions, Timing Signals, Instruction Cycle, Design of a Basic Computer.

SECTION–B

CPU Design General Register Organization, Stack Organized CPU, Instruction Formats, Addressing Modes, Program Control, Hardwired & Micro programmed (Wilhe's Design) Control Unit, RISC and CISC Characteristics.

SECTION–C

Memory Organization Memory Hierarchy, Designs & Concepts of Main Memory, Auxiliary Memory, Associative Memory, Cache and Virtual Memory.

SECTION–D

I/O Organization I/O Interface, Modes of Transfer, Program Interrupt, DMA & I/O Processor.

Pipeline & Vector Processing Introduction to Parallel Processing and Pipelining, SISD, SIMD & MISD, MIMD Machines.

References:

M.M. Mano Computer System Architecture: (PHI)
J.P. Hayes.Computer Architecture
Patterson & Hemessy Computer Architecture

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SEMESTER–III

Operating Systems

M. Marks: 100 **Credits**
Time: 3 Hours **L-T-P**
4-0-0

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 Outcomes:
1. To understand the services provided by and the design of an operating system.
2. To understand what a process is and how processes are synchronized and scheduled.
3. To understand the structure and organization of the file system.
4. To understand different approaches to memory management.
5. Students should be able to use system calls for managing processes, memory and the file system.

SECTION-A

Introduction: Definition, Early Systems, Simple Batch system, Multi-programming/Multi-Tasking, Time Sharing Systems, Personal Computer System, Parallel Systems, Distributed Systems, Real–time Systems.
Processes: Process concept, Inter Process communication, Process Scheduling, Threads.
CPU–Scheduling: Basic concepts, Scheduling Criteria, Scheduling Algorithms, Algorithm Evaluation.

SECTION–B

Process Synchronization: Critical – section problem, semaphores, classical problem of synchronization. Semaphores, **Threads:** Multicore Programming, Multithreading Models, Thread Libraries, Implicit Threading, Threading Issues.
Memory Management: Background, Logical v/s Physical address space, swapping, continuous allocation, paging, segmentation.

SECTION–C

Virtual Memory: Background, demand paging, performance of demand paging, page replacement, page replacement algorithms, thrashing.
Deadlocks: System Model, Deadlock characterization, methods for handing deadlocks, Deadlocks Prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock, combined approach to deadlock handling.

SECTION–D

Operating System Security – authentication & authorization, file ownership and user groups, Access Control, password vulnerabilities, strong passwords, Operating System protection from security breaches, such as runaway processes (denial of service), memory-access violations, stack overflow violations, the launching of programs with excessive privileges. Protecting against viruses and worms
CASE STUDY – Windows Operating System, Linux

Recommended Books & Materials:

1. Silberschatz, Galvin, and Gagne, Operating System Concepts, Global Edition, Wiley India 2023
2. Crowley, Operating Systems, A Design Oriented Approach, Tata McGraw Hill.
3. Dietel, Operating Systems, Second Edition by Addison Wesley.
4. William Stallings, Operating Systems –Internals and Design Principles, Pearson Publications
5. Andrew S. Tanenbaum, Modern Operating Systems, Pearson Publications
6. Remzi H. Arpaci-Dusseau and Andrea C. Arpaci-Dusseau, Operating Systems: Three Easy Pieces, https://pages.cs.wisc.edu/~remzi/OSTEP/

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SEMESTER–III
Cybersecurity Fundamentals
(SEC-2 Theory)

M. Marks: 50 **Credits**
Time: 3 Hours **L-T-P**
2-0-0

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.

Courseoutcome:

1. To teach fundamentals of Cyber Space, Cyber Threats and defense strategies,
2. understand the ethical, legal, and regulatory environment in the cyberspace.

SECTION- A

Introduction to the Internet, IP address, MAC address; Client-Server/P2P Architecture, Cloud Computing; Computation/ Storage as a service; confidentiality, Integrity, availability of information; desktop and mobile apps; Authentication & authorization; Data trails of an Internet user; cookies; Why security matters?

SECTION- B

Threats: Malicious software, Cyber threats, hackers, trackers, types of hackers, hacker motives; Types of Attacks: virus, worms, Trojan horse, spam, spoofing, phishing, spear-phishing, whaling, social engineering, ransomware, spyware, adware, malvertising, supply-chain attacks, zero-day viruses - software/hardware vulnerabilities, exploits; denial of service attacks; bots, botnets; Data breaches; risks of using public Wi-Fi; Cyber bullying;

SECTION- C

How to Safeguard: Using http/https; Anti-virus software, analysis of the tools available in the market; strong passwords/passphrases, password managers, changing passwords regularly; Cryptography: Encryption, Decryption, public/private cryptography, Digital signatures; Virtual private networks; Setting up private and secure Wi-Fi; Data backup and recovery – full/incremental/differential backup, backup vs archive; software updates/patches; URL filtering;

SECTION- D

privacy vs security vs anonymity, privacy settings in apps/browsers and popular social networking sites such as Facebook, Instagram, Snapchat; using web browser incognito mode, the tor browser;
Laws, regulations, and compliance; cybercrimes, Intellectual Property, Licensing, Compliance, Provisions in the IT act.

Reference Books:

1. Kenneth EinarHimma and Herman T. Tavani, Handbook of Information and Computer Ethics,Wiley.
2. Douglas E Comer, The Internet Book: Everything You Need to Know About Computer Networking and How the Internet Works, CRC Press
3. Introduction to cyber security: stay safe online, The Open University
4. Justice Yatindra Singh, Cyber Laws, Universal Law Publishing Co. (ULPC)
5. Anirudh Rastogi, Cyber Law-Law Of Information Technology And Internet, Lexis Nexis
6. James Graham, Ryanolson Rickhoward, Cyber Security Essentials By, CRC PRESS
7. R. K. Dhamija, Cybersecurity: An Introduction, BPB Publications
8. Charles J. Brooks, Christopher Grow, and Philip Craig, Cybersecurity Fundamentals by McGraw-Hill

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SEMESTER–III
Lab-2 based on Cybersecurity Fundamentals
(SEC-2 Practical)

M. Marks: 25
Time: 3 Hours

Credits
L-T-P
0-0-1
(2h/week)

Instructions for the examiners: -
Two questions of equal marks strictly as per the syllabus and based on the practical exercises covered in the semester. Questions may be subdivided into parts (not exceeding four). Candidates will attempt ONE question, explain their answer by writing on the answer sheet, and then implement the same on the computer. Examiner will evaluate both the answers (theory as well as practical). The viva will also be conducted one-on-one alongside, and the student asked viva questions related to the question and the solution he/she is working on during the exam.

Lab Exercises based on

- Find IP/MAC addresses on personal devices
- Set up a simple cloud service (e.g., Google Drive)
- Check browser cookies and understand privacy settings
- Conduct a phishing simulation to identify red flags
- Analyze secure connections, creation of strong passwords
- Configure a VPN on personal devices
- Data backup routine using a cloud service or external drive
- Adjust privacy settings on popular platforms like Facebook and Instagram
- Understand anonymity using Tor network
- Install and configure antivirus and anti-malware software
- Configure a firewall rule using pfSense or similar tools
- Use OpenSSL to encrypt and decrypt messages.

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SEMESTER–III

Information Systems
(MDC-5)

Total Marks: 100
Time: 3 hours

Credits
L T P
4 0 0

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 Outcome:

- It gives detailed knowledge about Information Systems (IS).
- This course makes the students aware about various organization levels and the information systems used at these levels like MIS, DSS, TPS and various other systems.
- It gives information about the career opportunities in the field of IS

SECTION–A

An Introduction to Information System: Information Concepts, System Concepts, Business Information Systems, Information Systems in society, business and Industry, Ethical and Social issues, Global Challenges in Information Systems

Information Systems in Organizations: organizations and Information systems, competitive Advantage, careers in Information System

SECTION–B

Management Information System: Fundamental types of Management, Information Systems, Management Decision, Pitfalls in MIS Development Making Process

Building and Maintaining Information Systems, Information System Security and Control

SECTION–C

Decision Support Systems (DSS): Conceptual Foundations of DSS, Concepts of DSS, DSS Software, Strategies for DSS, Group Support Systems, Executive Support System (ESS)';Expert systems, Expert System & its integration with DSS.

SECTION–D

Knowledge Management systems: Fundamentals of Knowledge Management; importance;The Knowledge Management Process; knowledge spiral; Knowledge Repositories and Databases; Knowledge Sharing Practices; Collaboration Tools: Email, Social Media, Enterprise Social Networks (e.g., Slack, Microsoft Teams).

Other Information Systems like Supply chain management, Customer Relationship Management (CRM), Electronic Commerce and Mobile Commerce.

References:

1. Principles of Information Systems: A Managerial Approach, Ralph Stair and George Reynolds, Cenage Learning, 2008
2. Management Information Systems, Laudon C. Kenneth &Laudon P. Janes, Pearson Education, 2002.

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SEMESTER-III

Internship with local public/private industry/ business /organization Field Practice – 3

M. Marks: 50
Time: 3 Hours

Credits
L-T-P
0-0-2
Field Practice (4h) /week

Course Outcomes:

- To put theory into practice
- To expand thinking and broaden the knowledge and skills acquired through course work in the field.
- To relate to, interact with, and learn from current professionals in the field.
- To understand and adhere to professional standards in the field
- To gain insight to professional communication
- To identify personal strengths and weaknesses
- To develop the initiative and motivation to be a self-starter and work independently

Internship/Professional practice: Internship/Professional practice can provide students the opportunity to enhance skills acquired in the curriculum so far. Students under the guidance of internal guide/s and external guide shall take part in all the activities regularly to implement as much knowledge as possible. The students shall take part in discussions to foster friendly and stimulating environment in which they are motivated to reach high standards and become self-confident.

Assessment: Each student, is required to

- Submit a report.
- Present the seminar on the internship orally through power point slides.
- Answer the queries.

Instructions for the Assessment:

- Candidates will undergo training and prepare an internship report. As End-Semester Examination, evaluation of the student will be based on the quality of report submitted, presentation skills and their response in the Q/A session by the examiners. The internship report carries 30 marks, seminar of 10 marks, and Q/A 10 marks.

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SEMESTER–IV
INTRODUCTION TO C++ PROGRAMMING

M. Marks: 75 **Credits**
Time: 3 Hours **L-T-P**
3-0-0

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 Outcomes:

- Understanding the difference between Traditional and Structured Programming.
- Introduces Object Oriented Programming concepts using the C++ language.
- Implementing security using Access specifiers.
- Understanding the creation of objects using different constructors.
- Implementing reusability of classes using Inheritance.

SECTION–A

Programming Paradigms: Introduction to the object oriented approach towards programming by discussing Traditional, Structured Programming methodology. A brief history of C++. Variable, Constant, Expression, Statements, Comments and keywords of C++, Preprocessor directives

Data Types and Operators: Data types, Type conversion. Operators and their Precedence

Input/Output Statements: Inputting using cin and outputting using cout statements,

Introduction to OOP's concepts: Class and Object Definition, accessing object members (public, private), Encapsulation,

SECTION–B

Decision Making and Looping statements: If statement, if.....else statement, nesting of if statement, switch statement, conditional operator statement. While loop, do loop, for loop, nesting of loops, break and continue statement, go to statement.

Arraysand Strings: Defining an array, Accessing & initializing array, array of objects, String handling, array of strings

Functions: Declaring and defining function, Local, global variables, Passing arguments, Return values, Reference arguments, Overloading functions, Inline function and default parameter, storage classes.

SECTION–C

Object Oriented Programming: Encapsulation, Data Hiding, Abstraction, Inheritance, Messages, Method, Polymorphism.

Objects & Classes, Constructor & Destructor,

Operator Overloading: Overloading unary operators, Overloading binary operators, Data conversion, Pitfalls operator overloading and conversion

Inheritance: Derived class and Base Class, Derived Class Constructors, Overriding member functions, class hierarchies, Public & Private inheritance, Levels of inheritance Polymorphism: Problems with single inheritance, Multiple inheritance.

SECTION–D

Structures:Structure and classes, Arrays of structure

Pointers: Addresses and pointers, Pointers to objects, Pointer to pointers.

Files & Streams: Overview of streams, String I/O, character I/O, Object I/O, I/O with multiple objects, File Pointers, Disk I/O with member functions, Redirections, Error handling, Command– line Argument, Creating Multifile Programs.

Reference Books:

1. Robert Lafore, Object oriented Programming in C++.
2. Ashok Kamthane, Object-Oriented Programming with ANSI and Turbo C++
3. Programming With C++ (Special Indian Edition) Schaum Outline Series
4. Herbert Schildt, C++: The Complete Reference

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SEMESTER–IV

LAB-1 based on Introduction to C++ Programming

M. Marks: 25 **Credits**
Time: 3 Hours **L-T-P**
0-0-1
(2h/week)

Instructions for the examiners: -
Two questions of equal marks strictly as per the syllabus and based on the practical exercises covered in the semester. Questions may be subdivided into parts (not exceeding four). Candidates will attempt ONE question, explain their answer by writing on the answer sheet, and then implement the same on the computer. Examiner will evaluate both the answers (theory as well as practical). The viva will also be conducted one-on-one alongside, and the student asked viva questions related to the question and the solution he/she is working on during the exam.

Lab Exercises based on:

1. Data Types, Type Conversion,
2. Operators and their precedence
3. Arrays, strings and string functions
4. implementation of if-else, else-if ladder, looping statements(while, do-while, for),
5. Functions and its types, reference variables, function overloading, inline functions.
6. Implementation of classes, creating objects, constructors and its types,
7. Operator overloading,
8. Inheritance and its types,
9. Polymorphism.
10. Implementing structures, array of structures, array of objects
11. pointers with functions, pointers with objects.
12. Creating files and performing I/O using streams

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SEMESTER–IV

DATABASE MANAGEMENT SYSTEMS

M. Marks: 75 **Credits**
Time: 3 Hours **L-T-P**
3-0-0

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 Outcomes:

1. Understand the fundamental concepts of databases and DBMS.
2. Design and implement relational databases using ER and UML diagrams.
3. Write complex SQL queries for data manipulation and retrieval.
4. Understand database normalization and optimization techniques.
5. Explore advanced topics such as transactions, security, and data warehousing

SECTION A

Introduction to Databases: Overview of databases and DBMS, History and evolution of database systems; Types of databases: Relational, NoSQL, Object-oriented; Relational model concepts::tables, rows, columns; Comparison of database models (Hierarchical, Network, Relational); **Entity-Relationship (ER) Modeling:** Introduction to ER diagrams, Entities, attributes, relationships, Designing a database using ER modelling

SECTION B

Relational Database Design: Converting ER diagrams to relational schemas; Relational integrity constraints, Understanding keys: Primary, Foreign, Composite; Normalization: 1NF, 2NF, 3NF, BCNF
Relational algebra operators like selection, projection, cartesian product, join and write queries using them.

SECTION C

SQL Fundamentals: Introduction to SQL: Syntax and structure, Data Definition Language (DDL): CREATE, ALTER, DROP, Data Manipulation Language (DML): INSERT, UPDATE, DELETE; **Advanced SQL Queries:** SELECT statements: WHERE, ORDER BY, GROUP BY; Joins: INNER, OUTER, CROSS, SELF; Subqueries and Common Table Expressions (CTEs).

SECTION D

Database Security: Understanding database security concepts, User roles and permissions, Data encryption and access control measures
Backup, Recovery, and Maintenance: Strategies for database backup and recovery, Disaster recovery planning, Regular maintenance practices for databases

Recommended books:

1. Silberschatz, Korth, and Sudarshan "Database System Concepts" by
2. John Viescas and Michael Hernandez "SQL Queries for Mere Mortals" by
3. Elmasri, R., Navathe, B. S., Fundamentals of Database Systems, 7th edition, Pearson Education, 2016.
4. Murach, J., Murach's MySQL, 3th edition, Pearson, 2019.
5. Connolly, T. M., Begg, C. E., Database Systems: A Practical Approach to Design, Implementation, and Management, 6th edition, Pearson, 2019.
6. Silberschatz, A., Korth, H.F., Sudarshan S., Database System Concepts, 7th edition, McGraw Hill, 2019.
7. R. K. Gupta, BPB Publications Database Management Systems by
8. John Date, Database Management Systems by Cengage
9. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems" by Pearson

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SEMESTER–IV

LAB-2 BASED ON DATABASE MANAGEMENT SYSTEMS

M. Marks: 25
Time: 3 Hours

Credits
L-T-P
0-0-1
(2h/week)

Instructions for the examiners: -
Two questions of equal marks strictly as per the syllabus and based on the practical exercises covered in the semester. Questions may be subdivided into parts (not exceeding four). Candidates will attempt ONE question, explain their answer by writing on the answer sheet, and then implement the same on the computer. Examiner will evaluate both the answers (theory as well as practical). The viva will also be conducted one-on-one alongside, and the student asked viva questions related to the question and the solution he/she is working on during the exam.

Lab Exercises based on:

- Familiarize with DBMS software
- Database Creation:, create simple databases and tables.
- ER Diagrams and Relational Schema: Design ER diagrams, convert them to relational tables with primary and foreign keys.
- Normalization: Apply 1NF, 2NF, and 3NF to optimize tables for minimal redundancy.
- Basic SQL Queries: Practice data retrieval using SELECT, WHERE, ORDER BY, GROUP BY, DISTINCT, BETWEEN, IN, LIKE, and aggregate functions (COUNT, SUM, AVG, MIN, MAX).
- Advanced SQL Joins: Practice INNER, OUTER, CROSS, and SELF joins on relational data.
- Subqueries: Write nested queries for complex data retrieval.
- User Roles and Security: Implement roles, permissions, and basic encryption for database security.

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SEMESTER–IV

COMPUTER NETWORKS

M. Marks: 100 **Credits**
Time: 3 Hours **L-T-P**
4-0-0

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 outcomes:
1. To develop an understanding of different components of computer networks, various protocols, modern technologies and their applications.
2. To understand the working principle of various communication protocols.
3. Study the basic taxonomy and terminology of the computer Networking and enumerate the layers of OSI model and TCP/IP model.
4. Gain core Knowledge of network layer routing protocols and IP addressing.
5. To know the concept of data transfer between nodes.

SECTION–A

Introduction: Network Definition, Basic Components of a Network, Network types andtopologies, Uses of Computer Networks.
Introduction to Analog and Digital Transmission: Telephone system, Modems, Types ofmodems, pulse code modulation.
Transmission Media: Coaxial cable, twisted pair cable, fiber optics & satellites.
OSI reference model, TCP/IP reference model, comparison of OSI and TCP reference models

SECTION–B

Transmission & Switching: Multiplexing, circuit switching, packet switching, hybrid switching. **Data Link Layer Design Issues:** Services provided to Network layer, Framing, error control,flow control, link management. Error detection & correction, Elementary Datalink Protocols.

SECTION–C

Local Area Network Protocols: CSMA Protocols, IEEE standards 802,Token Bus, Token Ring **Design Issues of Network Layer:** Services provided to transport layer, routing, connection.
Application layer protocols and client-server model - The Internet & World Wide Web

SECTION–D

Network Security:. Overview of threats, cryptography, authentication, and firewalls
Network Services: File transfer, Access & Management, Electronic Mail, Remote login
Wireless and mobile networks.

References:
1. A.S Tannanbum, Computer Networks, Prentice Hall.
2. William Stallings, Local Networks: An Introduction, Macmillan Publishing Co.
3. William Stallings, Data Computer Communication, Macmillan Publishing Co.

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SEMESTER–IV

SECURITY IN COMPUTING
(Minor)

M. Marks: 100 **Credits**
Time: 3 Hours **L-T-P**
4-0-0

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 Outcomes:

1. Introduction of fundamental principles of security and privacy in digital systems
2. Introduce the database and its security issues, and compare in details the various state-of-art database security methods and techniques.
3. Learn operating systems security and relevant tools to secure operating systems
4. Comprehend the necessity of network security along with the basic concept of Network security

SECTION- A

Fundamental principles of Security and Privacy in Digital Systems: Abstract components of a secure system: subjects, objects, access permission database, authentication, and audit. Least privilege. System assurance.
Risks in Security and Privacy: Identity theft, stalking, online victimization, surveillance. General threats to Security and Privacy: Threat actors – hackers, organized crime, and nations, states. Techniques (e.g. phishing etc.), attack vectors, tools.

SECTION- B

Operating System Security: Secure Operating Systems **-** Security goals, Trust model, Threat Model. Access Control Fundamentals – Protection system – Lampson's Access Matrix, Mandatory protection systems, Reference monitor. Security in Unix, Windows.
Verifiable security goals – Information flow, Denning's Lattice model, Bell-Lapadula model, Biba integrity model, Covert channels. Security Kernels – Secure Communications processor, Securing Commercial OS. Secure Capability Systems – Fundamentals, Security, Challenges. Secure Virtual Machine Systems. Case study of Android Operating System.

SECTION- C

Network Security: Introduction to Network Security, Need for Network Security, Network Security Fundamentals, Principles of Security, Working of internet and DNS Vulnerabilities, Secure Network Communication. Malware, Insider Attack and Defence.
Need For Physical Security, User Authentication Technologies, Environmental Attacks and Accidents, Firewall, Intrusion Detection System, Honeypot, Tunnelling, Virtual Private Network, Privacy Preserving Communication, Anonymity, Onion Routing.

SECTION- D

Database Security: Introduction to database security issues. Understanding database security concepts, User roles and permissions, Data encryption and access control measures; Cryptographic data protection. Triggers, views, data masking. Escaping queries to a database. Change Tracking. Data integrity in the databases.
Security features in databases - SQL statements for access control. Integrity (domain, attributes, tables, referential). Database monitoring and security analysis tools e.g. SQL injection detection and database vulnerability scanning. Case study of MySQL.

References:

1. Michael Goodrich, Roberto Tamassia, *Introduction to Computer Security*: Pearson publications, 2nd edition, 2021, ISBN-13: 978-0133575477.
2. Andrew S. Tanenbaum, *Modern Operating Systems*, Third Edition, Prentice Hall, 2007.
3. *Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts*
4. Basta A., Zgola M, "Database Security" 3nd Edition, Cengage Learning, US, 2011
5. Ron Ben Natan, "Implementing database security and auditing", Digital Press, 2005.

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SEMESTER–IV

ESL222 : Environmental Studies (Value Added Course) (CBGS)

Time: 3 Hrs. **Credits: 2-0-0**

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.

Note :As per the decision of the Academic Council meeting dated 17-01-2022, Item : 'X', atleast one visit is compulsory for students in the Pushpa Gujral Science City, Kapurthala during the entire course.

(i) ADVISORY FOR PUSHPA GUJRAL SCIENCE CITY, KAPURTHALA:

The Under Graduate **regular students** studying Environmental Studies (Compulsory Paper for All UG College Courses) may be taken to Pushpa Gujral Science City, Kapurthala during the course.

(ii) The **private students** are exempted from the Visit.

Section- A

1. The multidisciplinary nature of environmental studies

- Definition, scope and importance, Need for public awareness

2. Natural Resource and associated problems

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

SEMESTER–IV

Section- B

3. 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)

4. 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

Section- C

5. Environnemental Pollution

- Définition, 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

6. 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
- Public awareness

SEMESTER–IV

Section D

7. 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

8. Introduction to Environmental Laws, Environmental Audit and Impact Assessment

- Constitutional provisions- Article 48A
- Article51A(g) and other derived environmental rights
- 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
- Environmental risk assessment Pollution control and management
- Waste Management- Concept of 3R (Reduce, Recycle and Reuse)
- Ecolabeling /Ecomark scheme

Course Objectives:

At the end of this course, the students should be able to understand the scope and importance of environmental studies, different natural resources (forests, minerals, energy, water, land, food, biodiversity) and their utilization as well as conservation methods; importance of ecosystem structure and function; different types of environmental pollution (air, water, soil, thermal, nuclear and noise), Environmental Law and remedial methods. The students will also have to be introduced to various Acts and Last but not least the students should be made aware of the consequences of population explosion; diseases such as HIV/AIDS and various family welfare programs.

SEMESTER–IV

Learning Outcome:

- The present subject will help the student to gain knowledge about the effects of environmental pollution and remediation.
- Visiting to a local polluted site (including urban / rural / industrial / agricultural) will help to students to identify the causes, effects and remedial measures.
- After understanding the role of individual in conservation of environment, every individual would be able to follow the sustainable lifestyle patterns.
- The knowledge on environmental protection Acts and Rules will give them valuable glance on legal aspects towards conservation of environment.

References:

1. Bharucha, E. 2005. Textbook of Environmental Studies, Universities Press, Hyderabad.
2. Down to Earth, Centre for Science and Environment, New Delhi.
3. Heywood, V.H. &Waston, R.T. 1995. Global Biodiversity Assessment, Cambridge House, Delhi.
4. Joseph, K. &Nagendran, R. 2004. Essentials of Environmental Studies, Pearson Education (Singapore) Pte. Ltd., Delhi.
5. Kaushik, A. & Kaushik, C.P. 2004. Perspective in Environmental Studies, New Age International (P) Ltd, New Delhi.
6. Rajagopalan, R. 2011. Environmental Studies from Crisis to Cure. Oxford University Press, New Delhi.
7. Sharma, J. P., Sharma. N.K. &Yadav, N.S. 2005. Comprehensive Environmental Studies, Laxmi Publications, New Delhi.
8. Sharma, P. D. 2009. Ecology and Environment, Rastogi Publications, Meerut.
9. State of India's Environment 2018 by Centre for Sciences and Environment, New Delhi
10. Subramanian, V. 2002. A Text Book in Environmental Sciences, Narosa Publishing House, New Delhi.

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SEMESTER–IV
(Ability Enhancement Course) (AEC-5)

COMPILER DESIGN

Total Marks: 100	**Credits L T P**
Time: 3 hours	**4 0 0**

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 outcomes:

- To acquire basic skills for designing the compilers, as well as the knowledge of compiler design.
- Appreciation for programming language features and the implementation challenges they pose, as well as for the actual hardware architecture and the run-time system in which your generated code executes.
- Understanding the details of typical compilation models will also make students a more distinct programmer.

SECTION–A

Pre-requisites: Concepts of Programming Languages and Finite Automata.

Preliminaries: Basics of Compilers, Lexical Analysis.

Syntax Analysis: Parsers, top-down parsers, bottom-up parsers.

SECTION–B

Symbol Table Handling: Symbol table contents, operations on Symbol Tables, Organizations of Symbol Tables.

Syntax-Directed Translation: Syntax-Direction definitions, Evaluation of SDD, Dependency graphs.

SECTION–C

Storage Management: Static Storage Management, Dynamic Storage Management.

Code Generation: Code Generator, Code generation of simple programming constructs.

SECTION–D

Code Optimization: Local optimization, Machine independent optimizations

Introduction to Compiler-Compilers, incremental compilers, Case study : YACC.

References:

1. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman: *Compiler, Principles, Techniques andTools*, Addision Wesley, 2006.
2. Tremblay J.P., Sorenson P.G., *The Theory and Practice of Compiler Writing*, Mc-Graw Hill, 2007.
3. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman: *Principles of CompilerDesign,*Narosa Publishing House, 2007.

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SEMESTER–V

COMPUTER GRAPHICS

M. Marks: 75 **Credits**
Time: 3 Hours **L-T-P**
3-0-0

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 Outcomes:
1. Understand the basic concepts and algorithms in computer graphics.
2. Develop 2D and 3D graphics applications using appropriate programming languages and libraries.
3. Apply transformations and projections in 3D graphics.
4. Implement basic rendering techniques, including shading and texturing.
5. Explore advanced topics like animation and interactive graphics.
6.

SECTION–A

Overview of Graphics system: Computer Graphics and their applications. • Overview of Computer Graphics: History and applications of computer graphics, Types of graphics: 2D vs. 3D; Graphics Basic Concepts: Pixel, coordinates, color models, resolution, aspect ratio; Coordinate systems: Cartesian and homogeneous coordinates;
Display Devices: LED, LCD, and other contemporary Monitors.

SECTION–B

Elementary Drawing: Points and various line drawing Algorithms and their comparisons.Circle generating algorithms, Algorithms for ellipse, arc and spiral

SECTION–C

Two Dimensional Transformations: Basic Transformations, Scaling, Translation, Rotation, Reflection, Shear, Matrix representation of Basic transformations and homogenous coordinates.
Composite Transformations: Windowing and clipping. Windowing concepts, clipping and its algorithms. Window–to–view port transformations.

SECTION–D

Three Dimensional concepts. 3 D Coordinate Systems. 3D transformations. translation, scaling, rotation, projections, parallel projections. Perspective projection.
Rendering Techniques: Introduction to rendering pipelines, Hidden surface removal techniques (Z-buffering), Ray tracing basics.

References:
1. Donal Hearn M. Pardive Baker, Computer Graphics by (PHI) Easter Economy Edition.
2. Roy A. Plastock and Gordon Kalley, Computer Graphics by– Schaum's Series.
3. Marc Berger, Computer Graphics
4. V. S. K. Reddy, Fundamentals of Computer Graphics by BPB Publications
5. John F. Hughes et al., Computer Graphics: Principles and Practice by Pearson

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SEMESTER–V

LAB-1 BASED ON COMPUTER GRAPHICS USING C++

M. Marks: 25
Time: 3 Hours

Credits
L-T-P
0-0-1
One lab (2h) /week

Instructions for the examiners: -
Two questions of equal marks strictly as per the syllabus and based on the practical exercises covered in the semester. Questions may be subdivided into parts (not exceeding four). Candidates will attempt ONE question, explain their answer by writing on the answer sheet, and then implement the same on the computer. Examiner will evaluate both the answers (theory as well as practical). The viva will also be conducted one-on-one alongside, and the student asked viva questions related to the question and the solution he/she is working on during the exam.

Lab Exercises based on:

- Implement the DDA (Digital Differential Analyzer) algorithm for line drawing.
- Implement Bresenham's line drawing algorithm. Compare both algorithms based on accuracy and performance.
- Implement circle and ellipse drawing algorithms.
- Use the midpoint circle drawing algorithm to draw circles.
- Implement ellipse drawing using the midpoint ellipse algorithm.
- Draw arcs and spirals using a modified circle algorithm or trigonometric functions.
- Implement scaling, translation, rotation, reflection, and shearing on simple shapes (e.g., square, triangle).
- Implement the Cohen-Sutherland algorithm for line clipping.

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SEMESTER–V

WEB DESIGNING & DEVELOPMENT

M. Marks: 75 **Credits**
Time: 3 Hours **L-T-P**
3-0-0

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 Outcomes:

SECTION A

Introduction to Web Design and Development: Overview of web technologies and the web development process, Understanding the difference between web design and development, Introduction to HTML, CSS, and JavaScript

HTML Basics: Structure of an HTML document, Common HTML elements (headings, paragraphs, lists, links, images, Tables, Linking, Frames, Forms), Semantic HTML and its importance, Introduction to DOM.

SECTION B

CSS Fundamentals: Introduction to CSS and its role in web design, CSS selectors, properties, and values, Box model, layout techniques (flexbox, grid)

Responsive Design: Principles of responsive web design, Media queries and breakpoints, Using frameworks like Bootstrap for responsive layouts

SECTION C

JavaScript Basics: Introduction to JavaScript and its role in web development, Basic Programming Techniques & Constructs: Variables, data types, functions, and control structures, Operators, Functions, GET/POST Methods, DOM Manipulation & Event handling,

SECTION D

Forms Validation, Cookies, Inter-page communication and form data handling using JavaScript

Web Performance Optimization: Techniques for optimizing website performance, Using tools to analyze website performance, Importance and usage of SEO (Search Engine Optimization).

Recommended Textbooks:

1. Jon Duckett, HTML and CSS: Design and Build Websites
2. Jon Duckett, JavaScript and JQuery: Interactive Front-End Web Development"
3. Jennifer Niederst Robbins, Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics
4. Ben Frain, Responsive Web Design with HTML5 and CSS
5. Ethan Brown, Web Development with Node and Express
6. Terry Felke-Morris, Web Development and Design Foundations with HTML5, McGraw Hill
7. Jon Duckett, Beginning HTML, XHTML, CSS, and JavaScript, Cengage
8. Luke Welling and Laura Thomson, PHP and MySQL Web Development, Pearson Education

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SEMESTER–V
LAB-2 BASED ON WEB DESIGNING & DEVELOPMENT

M. Marks: 25 **Credits**
Time: 3 Hours **L-T-P**
0-0-1
One lab (2h)/week

Instructions for the examiners: -
Two questions of equal marks strictly as per the syllabus and based on the practical exercises covered in the semester. Questions may be subdivided into parts (not exceeding four). Candidates will attempt ONE question, explain their answer by writing on the answer sheet, and then implement the same on the computer. Examiner will evaluate both the answers (theory as well as practical). The viva will also be conducted one-on-one alongside, and the student asked viva questions related to the question and the solution he/she is working on during the exam.

Lab Exercises based on:

- Exploring Web Technologies and Setting up the Development Environment (e.g. Visual Studio Code)
- Creating HTML Documents using headings, paragraphs, lists, links, and images
- Advanced HTML Elements (create forms), applying CSS styles, understanding Box model, Layout techniques
- Integrate Bootstrap into the project and use its grid system to create a responsive layout
- Basic JavaScript programming: GET/POST methods, DOM Manipulation, Event handling, Form validation, working with cookies
- Analyze the performance of the developed webpage using tools like Google Page Speed Insights and Understanding basic SEO

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SEMESTER–V

MULTIDISCIPLINARY COURSE (MDC-6)

ETHICAL HACKING

Total Marks: 75	**Credits**	**L T P**
Time: 3 hours		**3 0 0**

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 ethical hacking, Understanding the ethical hacker's role; The hacking lifecycle (reconnaissance, exploitation, post-exploitation); Introduction to legal and ethical considerations, hacker types (White, Black, Gray Hat), penetration testing methodology, reconnaissance techniques , password cracking methods, social engineering techniques (Phishing, Vishing (voice phishing), Smishing (SMS phishing), Baiting, Impersonation), and real-world cyber threats.

SECTION–B

Kali Linux and Penetration Testing Tools: Installation and setup of Kali Linux, process management, and scripting (Bash), Network Penetration Testing, Detection, and Security–pre-connection, post connection, network scanning, vulnerability assessment, wireless security testing, and exploitation techniques using Metasploit.

SECTION–C

Web application testing (Burp Suite, SQLmap), Sever-side attacks, Metasploit remote code execution, Scanning Vulnerabilities Using Tools; Client-Side Attacks - Social Engineering, Twitter, emails; Attack and Detect Trojans with BeEF

SECTION–D

Real-World Applications, Case Studies, and Career Pathways; Case studies on real-world cyberattacks, introduction to bug bounty programs, red teaming vs. blue teaming, role of cybersecurity analysts, legal and ethical aspects of hacking, and career opportunities

References:

1. Kali Linux Revealed – Raphael Hertzog, Jim O'Gorman, MatiAharoni
2. The Basics of Hacking and Penetration Testing – Patrick Engebretson
3. Metasploit: The Penetration Tester's Guide – David Kennedy
4. CEH Certified Ethical Hacker Study Guide – Kimberly Graves

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SEMESTER–V

Lab-4 based on Ethical Hacking

Total Marks: 25
Time: 3 hours

Credits
L T P
0 0 1

Instructions for the examiners: -
Examiners will set TWO or more from the common subjects strictly as per the syllabus and based on the practical exercises covered in the semester. Questions may be subdivided into parts (not exceeding four). Candidates will attempt TWO questions, explain their answers by writing on the answer sheet, and then implement the same on the computer. Examiner will evaluate both the answers (theory as well as practical). The viva will also be conducted one-on-one alongside, and the student asked viva questions related to the question and the solutions he/she is working on during the exam.

Assessment: Logic and Code Structure in written: 20%, Implementation & Output: 40%,

Viva: 30%, File (mandatory):10%.

Lab Exercises based on

1. Using Kali Linux - Installing and configuring Kali Linux;
2. Basic Kali Linux commands for security testing;
3. Practicing vulnerability scanning and network analysis
4. Kali's tools Nmap, Metasploit, and Burp Suite;
5. Performing basic penetration testing on a virtual machine;
6. Reporting findings in a simulated penetration test;
7. Network reconnaissance and analysis

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SEMESTER–V

SOFTWARE ENGINEERING

M. Marks: 100 **Credits**
Time: 3 Hours **L-T-P**
4-0-0

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 Outcomes:

SECTION–A

Introduction to Software: Definition, Software characteristics, the evolving role of software, changing nature of software, Software components, Software Applications.
Introduction to Software Engineering: Definition, Software Engineering Paradigms, product vs project vs process, a process oriented framework, process patterns, waterfall method, prototyping, incremental process models, evolutionary process models, the unified process, the Spiral model, the agile process. Process assessment, the capability maturity model integration (CMMI)

SECTION–B

Software Requirement Specification (SRS): Problem analysis, structuring information, Data flow diagram and data dictionary, structured analysis, Characteristics and component of SRS.
Planning a Software Project: Cost estimation, uncertainties in cost estimation, Singlevariable model, COCOMO model, on software size estimation, Project scheduling and milestones, Software & Personal Planning, Rayleigh curve, Personal Plan, Quality Assurance Plan, Verification & Validation (V & V), inspection & review

SECTION–C

System Design: Design Objectives, Design Principles, problem, Partitioning, Abstraction, Top Down and Bottom–up techniques.
Coding: Coding by Top–down and Bottom–up, Structured Programming, Object Oriented Programming, Information Hiding, Programming style, Internal Documentation
Software Metrics: Role of Metrics and measurement, Metrics for software productivity and quality, Measurement software, size–oriented metrics, function oriented metrics, Object-oriented metrics, Metrics for software quality.

SECTION–D

Testing: Level of testing, Test cases and test criteria, Testing levels, Testing types: White box v/s black box testing: Functional Testing, Structural Testing.
Software Maintenance: Types of Maintenance, Corrective and Preventive Maintenance; Software Evolution, Change management

References:

1. Roger S. Pressman, Software Engineering
2. Pankaj Jalote, An Integrated Approach to Software Engineering

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SEMESTER–V

SERVER-SIDE PROGRAMMING
(SEC-3 Theory)

M. Marks: 50 **Credits**
Time: 3 Hours **L-T-P**
2-0-0

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 Outcomes:

SECTION A

Introduction: Overview of web application architecture (client-server model), Difference between client-side and server-side programming, server-side programming and its role in web applications, Introduction to HTTP and web protocols
Setting Up the Development Environment: Installing and configuring a web server (e.g., Apache, Nginx),
Introduction to Programming Languages: Overview of server-side programming languages (e.g., Python, Node.js, Java, PHP), Choosing the right language for specific applications, Basics of syntax and structure of Python
Buildinga Simple Web Application: Setting up a basic web server (using Node.js/Express or similar), Handling HTTP requests and responses, Rendering dynamic content

SECTION B

Working with Frameworks: Introduction to popular frameworks (Express for Node.js, Flask for Python, Spring for Java), Setting up a project using Flask for Python framework, Understanding the MVC (Model-View-Controller) architecture
RESTful API Development: Principles of REST architecture, Designing and implementing RESTful APIs, Handling CRUD operations with API endpoints

SECTION C

Database Interaction: Connecting to databases (SQL and NoSQL), Performing CRUD operations with a database (using an ORM), Managing database migrations
Authentication and Authorization: Understanding user authentication and session management, Implementing authentication strategies (JWT, OAuth), Protecting routes and resources
Error Handling and Debugging: Common error types in server-side applications, Best practices for error handling, Debugging techniques and tools

SECTION D

Web Security: Overview of common security vulnerabilities (SQL injection, XSS, CSRF), Implementing security measures (input validation, output encoding), Using HTTPS and securing APIs
Deployment and Hosting: Overview of cloud platforms (AWS, Heroku, Digital Ocean), Setting up and deploying a server-side application, Managing server resources and scaling applications

Recommended Textbooks:

1. David I. Schneider "Server-Side Programming with Java: A Comprehensive Guide" by
2. Miguel Grinberg "Flask Web Development" by
3. Leonard Richardson and Sam Ruby, RESTful Web APIs
4. “WEB TECHNOLOGIES A Computer Science Perspective” by Jeffrey C. Jackson
5. “Learning PHP, MySQL & JavaScript: A Step-By-Step Guide to Creating Dynamic Websites” by Robin Nixon (BPB Publications)

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SEMESTER–V

LAB-3 BASED ON SERVER-SIDE PROGRAMMING
(SEC-3 Practical)

M. Marks: 25
Time: 3 Hours

Credits
L-T-P
0-0-1
One lab (2h) /week

Instructions for the examiners: -
Two questions of equal marks strictly as per the syllabus and based on the practical exercises covered in the semester. Questions may be subdivided into parts (not exceeding four). Candidates will attempt ONE question, explain their answer by writing on the answer sheet, and then implement the same on the computer. Examiner will evaluate both the answers (theory as well as practical). The viva will also be conducted one-on-one alongside, and the student asked viva questions related to the question and the solution he/she is working on during the exam.

Lab Exercises based on:

- Setting Up a Flask Project and Implementing MVC Architecture in Flask
- Designing and Testing RESTful APIs
- Connecting to a SQLite or NoSQL Database and performing CRUD operations
- Implement user registration and login features using Flask-Login
- Use JWT for user authentication and Secure certain routes in the Flask application
- Best practices for error handling, Debugging techniques and tools
- Implementing security measures (input validation, output encoding), Using HTTPS and securing APIs
- Setting up and deploying a server-side application,
- Managing server resources and scaling applications

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SEMESTER–V

Internship with local public/private industry/business/organization Field – Practice-4

M. Marks: 50
Time: 3 Hours

Credits
L-T-P
0-0-2
Field Practice (4h) /week

Course Outcomes:

- To put theory into practice
- To expand thinking and broaden the knowledge and skills acquired through course work in the field.
- To relate to, interact with, and learn from current professionals in the field.
- To understand and adhere to professional standards in the field
- To gain insight to professional communication
- To identify personal strengths and weaknesses
- To develop the initiative and motivation to be a self-starter and work independently

Internship/Professional practice: Internship/Professional practice can provide students the opportunity to enhance skills acquired in the curriculum so far. Students under the guidance of internal guide/s and external guide shall take part in all the activities regularly to implement as much knowledge as possible. The students shall take part in discussions to foster friendly and stimulating environment in which they are motivated to reach high standards and become self-confident.

Assessment: Each student, is required to

- Submit a report.
- Present the seminar on the internship orally through power point slides.
- Answer the queries.

Instructions for the Assessment:

- Candidates will undergo training and prepare an internship report. As End-Semester Examination, evaluation of the student will be based on the quality of report submitted, presentation skills and their response in the Q/A session by the examiners. The internship report carries 30 marks, seminar of 10 marks, and Q/A 10 marks.

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SEMESTER–VI

PROGRAMMING IN JAVA
(Theory)

M. Marks: 75 **Credits**
Time: 3 Hours **L-T-P**
3-0-0

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 Outcomes:

- To understand the fundamental concepts of Object Oriented Programming viz. classes, objects, encapsulation, inheritance, polymorphism etc.
- To use different variables of varying data types, operators, control structures for developing solutions to real world problems
- To solve real world problems using java programming
- To use input and output streams to read and write data
- To handle the exceptions in programs using exception handling mechanism of java
- To access, define and use the packages and interfaces in java
-

SECTION–A

Introduction to Java: Importance of JAVA to Internet, Features of JAVA, Bytecode, Object Oriented Approach. The Java Environment: Installing Java, Java Program Development , Java Source File Structure ,Compilation, Executions. **Data Types, Variables and Arrays: Data types, Declaration of Variable, Type Conversion and Casting, One Dimensional and Multidimensional arrays, String handling.**

SECTION–B

Operators and Control Structures: Arithmetic, Bitwise, Relational, Boolean, Assignment Operators, Operator precedence, Selection Statements, Iteration Statements, Jump statements.
Classes: Class Fundamentals, Declaring objects, introducing methods, constructors, this keyword, Overloading constructors, Recursion, Nested and Inner classes.

SECTION–C

Inheritance: Basics, Types of Inheritance in Java, Inheriting Data members and Methods Creating Multilevel hierarchy, Method Overriding, Abstract Classes, Role of Constructors in inheritance , Overriding Super Class Methods ,Use of "super", Polymorphism in inheritance
Packages & Interfaces: Packages, Access Protection, Importing Packages, Organizing Classes and Interfaces in Packages, Package as Access Protection , CLASSPATH Setting for Packages Interfaces, Defining, Implementing, Applying Interfaces, Extending Interfaces

SECTION–D

Exception Handling: Fundamentals, Exception Types, uncaught exceptions, try and catch,
Input/Output Operation in Java(java.io Package), Streams and the new I/O Capabilities ,Understanding Streams, The Classes for Input and Output, The Standard Streams, Working with File Object, File I/O Basics, Reading and Writing to Files

Reference Books:

1. Patrick Naughton & Herbert Schildt: The Complete Reference Java, Tata McGraw Hill Edition.
2. E. Balagurusamy: Programming in JAVA, Tata McGraw Hill
3. Herbert Schildt, Java - A Beginners Guide, Oracle Press

Bachelor of Computer Applications (Honours) (CBGS)
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SEMESTER–VI
LAB-1 BASED ON PROGRAMMING IN JAVA
(Practical)

M. Marks: 25
Time: 3 Hours

Credits
L-T-P
0-0-1
(45 Hrs)

Instructions for the examiners: -
Two questions of equal marks strictly as per the syllabus and based on the practical exercises covered in the semester. Questions may be subdivided into parts (not exceeding four). Candidates will attempt ONE question, explain their answer by writing on the answer sheet, and then implement the same on the computer. Examiner will evaluate both the answers (theory as well as practical). The viva will also be conducted one-on-one alongside, and the student asked viva questions related to the question and the solution he/she is working on during the exam.

Lab exercises based on:

1. Java Data Types,
2. Variable declarations and scope, type casting,
3. String handling,
4. Operators,
5. Control Statements,
6. Arrays (One and Two dimensional arrays),
7. Classes and objects (declaring objects, methods, overloading constructors, recursion), Inheritance (Multilevel hierarchy, Method overriding, Abstract classes),
8. creating and importing packages,
9. applying and extending interfaces,
10. exception handling and
11. Input and Output streams

Bachelor of Computer Applications (Honours) (CBGS)
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SEMESTER–VI

SOFTWARE PROJECT

M. Marks: 300

Credits
L-T-P
0-0-12

General Instructions:

1. Student will choose a topic in which they will apply knowledge and skills gained from the courses taught and through the internships, self-study etc. The topic should be a great value addition to their career and solve real world problems, society problems, technical problems and that aims to handle current and future industry trends. Students are expected to apply good practice they have already learned during previous semesters, as well as learning any new technologies and other material which may be necessary to progress their work.
2. A student can work individually or in a group (of maximum two students) under the guidance of a supervisor. Group project should be substantially large to justify work of two persons.
3. A project has to have a major development/ implementation part, either in software or hardware or both. It cannot be a completely theoretical topic or a training program.
4. There are four "deliverables" — an initial formal title and project requirements (by 20th Jan), a complete design document (by 20th March), a draft report (by 20th April), and a complete working project with report submission (by 20th May).
5. A student will submit at the end a project report in the prescribed outline, formatting instructions, and title page layout as given in the table below:

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SEMESTER–VI

Table 1: Details for the Project Report

Prescribed outline for the project report	Formatting Instructions:	Title Page Layout
1. TitlePage 2. Declaration 3. CertificatefromtheProject 4. Acknowledgement 5. Abstract 6. TableofContents 7. ListofFigures 8. ListofTables 9. Listofacronymsandabbreviations 10. Introductiontotheprojecttopic 11. ProblemStatement 12. ProjectObjectives 13. SoftwareDevelopmentLifeCycleanditsdeliverablesastheprojectprogresses • RequirementGatheringandAnalysis • FeasibilityStudy • Design • Coding-completecodeisnotrequired.Youcanaddimportantcodesnippets.- • ImplementationandTesting • Building and Deployment 14. Limitationsoftheproject 15. ConclusionsandFutureWork 16. References 17. Annexures(optional)	**Margins:** Left margin -1.3 inch, Right margin-1 inch, Top margin: 1 inch, Bottom margin: 1 inch **Page numbers:** – All pages should be numbered at the bottom center of the pages. **Chapter Heading**: Font Size: 20, Times New Roman, Centre-Aligned, 30 point above and belowspacing. **Section Heading**: Font Size: 14, Times New Roman, Underlined, Left-Aligned. 12 point above & below spacing. **Normal Body Text:** Font Size: 12, Times New Roman, 1.5 Spacing, Justified, 6 point above & below paragraph spacing **Figure and Table Captions:** Font Size: 12, Times New Roman, centered **Coding Font:** size:10, Courier New, Normal Good quality white paper A4 size should be used for typing and duplication.	TITLE OF THE PROJECT REPORT (Times New Roman, Font size 24) Project Report Submitted to the Faculty of Computer Technology for the partial fulfilment of the requirements of (Times New Roman, Font Size= 14) NAME OF THE DEGREE (Times New Roman, Font Size= 16) Supervised by: Submitted by: SUPERVISOR NAME STUDENT NAME AND ROLL NO (Times New Roman, Font Size= 14) University LOGO DEPARTMENT/COLLEGE NAME AND ADDRESS (Times New Roman, Font Size 16) DATE (Times New Roman, Font Size= 14)

Bachelor of Computer Applications (Honours) (CBGS)
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SEMESTER–VI
ADVANCED WEB DEVELOPMENT
(Minor Theory)

M. Marks: 75 **Credits**
Time: 3 Hours **L-T-P**
3-0-0
(45 Hrs)

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 Outcomes:

- Learn advanced front-end and back-end web development techniques.
- Explore modern frameworks, libraries, and tools used in web development.
- Understand secure and scalable web application architecture.
- Gain hands-on experience in building and deploying full-stack web applications.

SECTION-A

Advanced Front-End Development: JavaScript Modules, Destructuring, Arrow Functions, Promises, Async/Await; Advanced DOM Manipulation: Event delegation, Custom events, Intersection Observer; Web Accessibility: ARIA roles, semantic HTML, designing for inclusivity; Advanced CSS Techniques: Flexbox, Grid, CSS Animations, CSS Variables.

SECTION-B

Frameworks and State Management: React.js: Component-based architecture, JSX/Template syntax, hooks or services; State Management: Redux, Context API; Routing: Single Page Applications (SPAs) with React Router; Front-End Testing: Unit testing, E2E testing; Introduction to Progressive Web Apps (PWAs): Service workers, manifest, offline support.

SECTION-C

Node.js: Event-driven programming, asynchronous I/O, modules; REST ful APIs: Designing endpoints, CRUD operations, Postman testing.

Database Integration: Connecting to relational (MySQL/PostgreSQL), NoSQL (MongoDB) databases; Authentication: Sessions, OAuth2, and JSON Web Tokens (JWT).

SECTION-D

Web Performance Optimization: Browser rendering and optimization techniques; Image optimization and lazy loading; Minification and bundling with Webpack; Caching strategies (HTTP caching, service workers); Content Delivery Networks (CDNs)

Secure Back-End Development: Secure Web Applications; Common web vulnerabilities (SQL Injection, XSS, CSRF), Preventing SQL Injection, Cross-Site Scripting (XSS), and CSRF; Secure coding practices and input validation; HTTPS and secure cookie handling; Introduction to Web Application Firewalls (WAFs)

Recommended References:

1. Juha Hinkula, Full Stack Development with Spring Boot and React, (Indian Edition), Packt Publishing
2. Web Technologies: HTML, CSS, JavaScript, PHP, Java, JSP, XML, and AJAX, Black Book (Indian Edition), Dreamtech Press

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SEMESTER–VI
LAB-2 BASED ON ADVANCED WEB DEVELOPMENT
(MINOR PRACTICAL)

M. Marks: 25
Time: 3 Hours

Credits
L-T-P
0-0-1
(30 Hrs)

Lab Exercises based on:

1. Create a responsive webpage using CSS Grid and Flexbox.
2. Implement a web animation using CSS keyframes.
3. Build an accessible webpage with ARIA roles and semantic HTML.
4. Implement a custom event listener for form validation.
6. Use the Intersection Observer API to lazy-load images.
7. Build a React.js application with functional components and hooks.
8. Implement state management in a React.js app using Context API or Redux.
9. Create a single-page application with routing using React Router
10. Develop a basic PWA with a service worker and offline capabilities.
11. Set up a simple web server using Node.js and Express.js.
12. Build a RESTful API with CRUD operations using Express.js.
13. Connect a Node.js application to MongoDB and perform basic queries.
14. Implement a login system with user authentication using JWT and bcrypt.
15. Create a real-time chat application using WebSockets in Node.js.
16. Develop a notification system using server-sent events (SSE).
17. Use Redis for caching in a Node.js application to improve performance.
18. Optimize API response times with query optimization and indexing in MongoDB.
19. Implement a file upload feature with front-end validation and server-side storage.

SEMESTER–VI

PSL061: HUMAN RIGHTS AND CONSTITUTIONAL DUTIES

(Value Added Course)

Time: 3 Hrs:

Credit: 2

Total 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

INTRODUCTION TO HUMAN RIGHTS

Foundational Aspects: Meaning, Nature, Characteristic, Classification.

International Framework: Constituents of the Universal Declaration of Human Rights (UDHR).

SECTION-B

INDIAN PERSPECTIVE OF HUMAN RIGHTS

Constitutional Realisation in India: Fundamental Rights (Part III, Constitution of India).

Protective Mechanism in India: The composition, Powers and Functions of the National Human Rights Commission of India (NHRC).

SECTION – C

INTRODUCTION TO HUMAN DUTIES

Conceptual Perspective: Meaning, Nature & Characteristics of Human Duties.

Intellectual discourses: Classification of Human Duties; Relevance of Human Duties

SECTION – D

INDIAN PERSPECTIVE OF HUMAN DUTIES

Constitutional Recognition in India: Fundamental Duties in Indian Constitution, Part IV A.

Intellectual Discourse: Critical Analysis and Significance of Fundamental Duties

Readings List

1. United Nations. The *United Nations and Human Rights 1945-1995*. Geneva: United Nations Blue Books Series, Vol. VII, 1996.
2. Sastry, S. N. *Introduction to Human Rights and Duties*. Pune: University of Pune Press, 2011.
3. Mertus, Julie. *The United Nations and Human Rights-A Guide for a New Era*. London: Routledge, 2009.
4. Donnelly, Jack. *Universal Human Rights in Theory and Practice*. New York: Cornell University Press, 2013.
5. Hammarberg, Thomas. *Taking Duties Seriously- Individual Duties in International Humanitarian Law*. Versoix: International Council on Human Policy, 1999.
6. Miller P. Frederic, *et al. Fundamental Rights, Directive Principles and Fundamental Duties in India*. New York: VDM Publishing, 2009.
7. Cinganelli, Davis Louis. *Human Rights- Theory and Measurements*. London: Macmillan Press, 1988.
8. Ishay, M. R. *The History of Human Rights*. New Delhi: Orient Longman, 2004.
9. Mohapatra, Arun Ray. *National Human Rights Commission of India: Formation, Functioning and Future Perspectives*. New Delhi: Atlantic, 2004.
10. Deol, Satnam Singh. *Human Rights in India-Theory and Practice*. New Delhi: Serials Publications, 2011

Bachelor of Computer Applications (Honours) (CBGS)
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SEMESTER–VII

CLOUD COMPUTING

M. Marks: 100 **Credits**
Time: 3 Hours **L-T-P**
4-0-0

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 Outcomes:

1. Understand the fundamental concepts and models of cloud computing.
2. Analyze different cloud service and deployment models.
3. Implement and manage cloud-based solutions using popular platforms.
4. Evaluate security and compliance issues in cloud computing.
5. Develop applications that leverage cloud services.

SECTION- A

Introduction and Overview: Definition and characteristics of cloud computing, History and evolution of cloud computing, Benefits and challenges of cloud computing

Cloud Computing Architecture: Basic architecture of cloud computing, Components: Front-end, back-end, cloud service models; Virtualization technology and its role in cloud computing; **Service Models:** Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), Comparison of service models and use cases

SECTION- B

Cloud Deployment Models: Public cloud: Characteristics, benefits, and examples; Private cloud: Characteristics, benefits, and examples; Hybrid cloud: Integration of public and private clouds; Community cloud: Shared infrastructure for specific communities

Cloud Providers and Platforms: Overview of major cloud service providers (AWS, Azure, Google Cloud), Features and services offered by each provider, Cost models and pricing strategies

Cloud Storage and Data Management: Types of cloud storage: Block, file, object storage; Data management strategies in the cloud; Backup and disaster recovery in cloud environments

SECTION- C

Security in the Cloud: Key security concepts: Confidentiality, integrity, availability; Cloud security architecture and controls; Identity and access management (IAM) in the cloud

Cloud Monitoring and Management: Tools and techniques for monitoring cloud resources, Performance management and optimization, Incident response and remediation in cloud environments

SECTION- D

Cloud Application Development: Overview of cloud-native application development, Microservices architecture and containerization (Docker, Kubernetes), Serverless computing concepts and platforms (AWS Lambda, Azure Functions)

Future Trends and Challenges: Emerging trends in cloud computing, Challenges and considerations for cloud adoption, Case studies of successful cloud implementations

Recommended Books:

1. Thomas Erl, Zaigham Mahmood, and Ricardo Puttini**,** Cloud Computing: Concepts, Technology & Architecture
2. Michael J. Kavis**,** Architecting the Cloud: Design Decisions for Cloud Computing Service Models
3. Judith S. Hurwitz, Robin Bloor, Marcia Kaufman, and Fern Halper,Cloud Computing for Dummies
4. Rajkumar Buyya, James Broberg, Andrzej Goscinski, Cloud Computing : principles and paradigms, Pearson Education
5. Anthony T. Velte, Toby J. Velte, and Robert Elsenpeter, Cloud Computing: A Practical Approach, McGraw Hill Education

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SEMESTER–VII

ENTREPRENEURSHIP DEVELOPMENT

M. Marks: 100 **Credits**
Time: 3 Hours **L-T-P**
4-0-0

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 Outcomes:

- Students imbibe an entrepreneurial mind-set.
- The students will learn what entrepreneurship is and how it has impacted the world and their country. They will be introduced to key traits and the DNA of an entrepreneur, and be given an opportunity to assess their own strengths and identify gaps that need to be addressed to become a successful entrepreneur.

SECTION - A

Introduction to Entrepreneurship: Entrepreneur, Functions and Qualities of Entrepreneur, Types of Entrepreneurs, Challenges before entrepreneurs in modern era. Entrepreneurship, Factors motivating Entrepreneurship, Obstacles in Entrepreneurship, Entrepreneurship theories: Joseph Schumpeter's Innovation theory, McClelland's theory of need for achievement, The Uncertainty-Bearing Theory of Knight. Creativity and Innovation: A Necessity for Entrepreneurial Success, Need for Innovation and Value Addition, Entrepreneur as an Innovator and Problem Solver.

SECTION - B

Entrepreneurship Development, Objective of Entrepreneurship Development, Process of Entrepreneurship Development, Problems and measures in India. New Dimensions of Entrepreneurship: Start up- Mobilizing resources for Startup, Stand up- Concept and Importance, Make in India, Incubation Centre, Government Schemes for Entrepreneurs: Pradhan Mantri Mudra Yojana (PMMY), Micro, Small and Medium Enterprises (MSME), Problems of MSME and Remedies, Steps involved in the formation of MSME, Registration Procedure to acquire license to run sole proprietorship, Udyog Aadhar, Procedure to obtain Udyog Aadhar from Ministry of MSME.

SECTION - C

Developing a Project idea, brain storming, validation of a project idea,
Project Management: Meaning and concept of project, Importance of project, Stages of Project management.
Report Writing: Meaning of a project report, Contents of a Project report, Preparation of a Project report. Writing a successful project report

SECTION - D

Entrepreneurship in Different Sectors : Women Entrepreneurship, Rural Entrepreneurship, Agro-tech Entrepreneurship, Retail Entrepreneurship, Lessons from Successful Entrepreneurs: JRD Tata- Tata Group, Jeff Bezos- Amazon, Jack Ma- Alibaba Group, Kiran Mazumdar Shaw -Biocon Limited.

Recommended Books & Materials:

1. H. Nandan, Fundamentals of Entrepreneurship by Third Edition, PHI Learning private limited, Delhi.
2. Dr. Amit Kumar, Dr. Amita Dubey, Dr. Pooja Pandey, Fundamentals of Entrepreneurship, Sahitya Bhawan Publications.
3. Bjorn Bjerke, Understanding Entrepreneurship, Edward Elgar publishing limited .

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SEMESTER–VII

MOBILE APPLICATION DEVELOPMENT

M. Marks: 75 | **Credits**
Time: 3 Hours | **L-T-P**
3-0-0

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 Outcomes:

- Learn about different mobile platforms like Android and the tools needed to develop apps.
- Develop Android application with User interface, networking and animation.
- Use simulator tools to test and publish the application

SECTION–A

Mobile Application Development: features to guide mobile application development: capability, reliability, usability, charisma, security, performance, mobility and compatibility; Mobile Applications and Device Platforms, Alternatives for Building Mobile Apps, Comparing Native vs. Hybrid Applications, The Mobile Application Development Lifecycle, The Mobile Application Front-End, The Mobile Application Back-End.

Key Mobile Application Services: What is Android-Android version history, Obtaining the Required Tools, Launching Your First Android Application, Exploring the IDE-Debugging Your Application, Publishing Your Application.

SECTION–B

Understanding Activities: Linking Activities using Intents and Fragments. Displaying Notifications, Understanding the Components of a Screen, Adapting to Display Orientation-Managing Changes to Screen Orientation. Utilizing the Action Bar, Creating the User Interface Programmatically Listening for UI Notifications.

SECTION–C

Using Basic Views: Using Picker Views, Using List Views to Display Long Lists-Understanding Specialized Fragments, Using Image Views to Display Pictures, Using Menus with Views using Web View, Saving and Loading User Preferences. Persisting Data to Files, Creating and Using Databases

SECTION–D

Sharing Data in Android: Creating Your Own Content Providers, Using the Content Provider SMS Messaging, Sending Email, Displaying Maps, Getting Location Data- Monitoring a Location; Consuming Web Services Using HTTP, Consuming JSON Services

Recommended Books & Materials:

1. Jerome DiMarzio, Beginning Android Programming with Android Studio", 4thEdition.
2. Eran Boudjnah, Clean Architecture for Android: Implement Expert-led Design Patterns to Build Scalable, Maintainable, and Testable Android Apps, BPB Publications
3. Hafedh Al-Shihi, Naveen Safia, Mohamed Sarrab, Handbook of Mobile Application Development: A Guide to Selecting the Right Engineering and Quality Features, Bentham Science Publishers
4. Dawn Griffiths, David Griffiths, Head First Android Development: A Brain-Friendly Guide
5. Neil Smyth , Android Studio 3.0 Development Essentials: Android, 8th Edition.
6. Pradeep Kothari, Android Application Development, Black Book 2014.

https://developer.android.com/

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SEMESTER–VII
LAB-1 BASED ON MOBILE APPLICATION DEVELOPMENT

M. Marks: 25
Time: 3 Hours

Credits
L-T-P
0-0-1
Lab 2h/week

Instructions for the examiners: -
Two questions of equal marks strictly as per the syllabus and based on the practical exercises covered in the semester. Questions may be subdivided into parts (not exceeding four). Candidates will attempt ONE question, explain their answer by writing on the answer sheet, and then implement the same on the computer. Examiner will evaluate both the answers (theory as well as practical). The viva will also be conducted one-on-one alongside, and the student asked viva questions related to the question and the solution he/she is working on during the exam.

Lab Exercises based on:

1. Creating applications that utilize various GUI components for basic tasks such as displaying some product details.
2. Expand skills by incorporating interactive elements like radio buttons and image buttons, and handling user interactions with Alert Dialog Boxes and Layout Managers.
3. Playing audio/video
4. Progress to mobile-specific features by developing applications that manage audio modes (NORMAL, SILENT, VIBRATE), send messages, send emails, and facilitate mobile calls.
5. Work on applications for specific functionalities such as student mark sheet processing and Google map location services.

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SEMESTER–VII
ARTIFICIAL INTELLIGENCE

M. Marks: 100 **Credits**
Time: 3 Hours **L-T-P**
4-0-0

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 Outcomes:
1. To understand the different needs and benefits of Artificial Intelligence, intelligent agents and different searching techniques.
2. To develop semantic-based and context-aware systems.
3. To acquire, organize process, share and use the knowledge embedded in multimedia content.
4. To understand the basic areas of artificial intelligence including knowledge representation, reasoning, learning, natural language processing, fuzzy systems and ANN.

SECTION–A
AI Introduction, foundation of AI and history of AI .Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation. Searching- Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Hill climbing, A* ,AO* Algorithms, Problem reduction, Game Playing-Adversial search, Games, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha-Beta pruning, Evaluation functions.

SECTION–B
Introduction to knowledge-based intelligent systems: Intelligent machines, Introduction to
Expert Systems. Logic and Inferences: Propositional Logic, First Order Logic (FOL),
Resolution method for FOL, Forward and Backward chaining.
Fuzzy Sets: Notion of Fuzziness, Membership Functions, Fuzzification and Defuzzification Operations on Fuzzy Sets, Fuzzy Functions and Linguistic Variables; FuzzyRelations, Fuzzy Rules and Fuzzy Inference; Fuzzy Control System and Fuzzy Rule BasedSystems.

SECTION–C
Natural Language Processing: Natural Language Processing (NLP) Introduction ,overview of linguistics, Grammars and Languages, Basic Parsing Techniques, syntactic Processing, Semantic Analysis, Natural Language Generation , Natural Language Systems.
Learning Introduction, Role of Learning, Types of Learning , General Learning Model, Performance Measures.

SECTION–D
Probabilistic Reasoning: Representation, Bayesian Networks, Conditional Independence.
Making Simple Decisions: Beliefs, Desires and Uncertainty, Decision Networks, Value of
Information. Making Complex Decisions: Stochastic Problems

Recommended Books & Materials:

1. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems, Prentice- Hall India Private Limited, 2006.
2. Rich Knight, Artificial Intelligence, Tata McGraw Hill, 2007.
3. P H. Winston, Artificial Intelligence, (3rd Edition), Addison Wesley, 2006.
4. E Charniak and D Mcdermott, 'Introduction to Artificial Intelligence', Addison Wesley, 2004
5. Bishop, Christopher. Neural Networks for Pattern Recognition. New York, NY: Oxford University Press, 1995. ISBN: 9780198538646.
6. Duda, Richard, Peter Hart, and David Stork. Pattern Classification. 2nd ed. New York, NY: Wiley-Interscience, 2000. ISBN: 9780471056690.

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SEMESTER–VII

DATA ANALYTICS
(Minor-1 Theory)

M. Marks: 75 **Credits**
Time: 3 Hours **L-T-P**
3-0-0

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 Outcomes:

1. Understand the data analytics lifecycle and methodologies.
2. Apply statistical techniques to analyze data.
3. Utilize data visualization tools to present findings effectively.
4. Employ programming languages and tools for data analysis.
5. Analyze data-driven solutions for real-world problems.

SECTION- A

Overview of Data Analytics: Definition and importance of data analytics, Types of data analytics: Descriptive, diagnostic, predictive, and prescriptive; The data analytics lifecycle

Data Collection and Preparation: Data sources: Structured and unstructured data; Data collection methods (surveys, web scraping, APIs); Data cleaning and pre-processing techniques

Introduction to Statistics for Data Analytics: Descriptive statistics (mean, median, mode, variance), Inferential statistics (hypothesis testing, confidence intervals), Overview of statistical distributions (normal, binomial, etc.)

SECTION- B

Exploratory Data Analysis (EDA): Techniques for exploring data patterns and trends, Using summary statistics and visualizations, Identifying outliers and anomalies

Data Visualization Principles: Importance of data visualization in analytics, Best practices for effective visualizations, Matplotlib, Seaborn for data visualization

Advanced Statistical Techniques: Regression analysis (linear and logistic regression), Correlation vs. causation, ANOVA and chi-square tests

SECTION- C

Introduction to Programming for Data Analytics: Overview of Python for data analysis, Data manipulation with libraries (Pandas, NumPy), Writing functions and scripts for analysis

Data Management and Databases: Data extraction using SQL queries, Integrating databases with analytics tools

SECTION- D

Business Intelligence and Analytics: Role of data analytics in business decision-making, Key performance indicators (KPIs) and metrics, Case studies of successful data analytics applications

Ethical Considerations in Data Analytics: Data privacy and security issues, Ethical use of data and analytics, Regulatory compliance (GDPR, CCPA)

Recommended books:

1. Anil Maheshwari, Data Analytics, McGraw Hill.
2. Gaurav Arora, Data Analytics: Principles, Tools, and Practices: A Complete Guide for Advanced Data Analytics Using the Latest Trends, Tools, and Technologies.
3. AmitSachan, Arulanantha Prabu, Business Statistics Using Python 1st Edition, McGraw Hill
4. **A** S. D. B. Shapiro**,** Data Analytics: A Comprehensive Guide to Data Analysis
5. Wes McKinney**,** Python for Data Analysis
6. Peter Bruce and Andrew Bruce, Practical Statistics for Data Scientists

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SEMESTER–VII
LAB-2 BASED ON DATA ANALYTICS
(Minor-1Practical)

M. Marks: 25
Time: 3 Hours

Credits
L-T-P
0-0-1
Lab 2h/week

Instructions for the examiners: -
Two questions of equal marks strictly as per the syllabus and based on the practical exercises covered in the semester. Questions may be subdivided into parts (not exceeding four). Candidates will attempt ONE question, explain their answer by writing on the answer sheet, and then implement the same on the computer. Examiner will evaluate both the answers (theory as well as practical). The viva will also be conducted one-on-one alongside, and the student asked viva questions related to the question and the solution he/she is working on during the exam.

Lab Exercises based on:

- Install and set up Jupyter Notebook, Python, and relevant libraries (Pandas, NumPy, Matplotlib).
- Collect sample datasets from various sources (CSV files, web scraping basics).
- Perform basic data cleaning tasks (handling missing values, standardizing formats).
- Calculate and interpret descriptive statistics (mean, median, mode, variance) using Python.
- Use Python libraries to calculate and visualize distributions (e.g., normal, binomial).
- Conduct EDA **(**Exploratory Data Analysis) on a sample dataset using summary statistics.
- Identify trends, patterns, outliers, and missing values.
- Create different visualizations (histograms, scatter plots, box plots) using Matplotlib and Seaborn.
- Perform and interpret regression analysis (linear and logistic regression) on sample datasets.
- Manipulate datasets using Pandas and NumPy (sorting, filtering, grouping).
- Perform basic SQL queries (SELECT, JOIN, GROUP BY) on a sample database.

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SEMESTER–VII

Internship with Local Public/Private/Govt. Industry/Business/Organization

Field Practice-5

Credits: 0-0-2
Field Practice (4h) /week
Total Marks: 50

Course Outcomes:

- To put theory into practice
- To expand thinking and broaden the knowledge and skills acquired through course work in the field.
- To relate to, interact with, and learn from current professionals in the field.
- To understand and adhere to professional standards in the field
- To gain insight to professional communication
- To identify personal strengths and weaknesses
- To develop the initiative and motivation to be a self-starter and work independently

Internship/Professional practice: Internship/Professional practice provide students the opportunity to enhance skills acquired in the curriculum so far. Students under the guidance of internal guide/s and external guide shall take part in all the activities regularly to acquire as much knowledge as possible. The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Assessment: Each student, is required to

- Submit a report.
- Present the seminar on the internship orally and/or through power point slides.
- Answer the queries.

Instructions for the Assessment:

- Candidates will undergo training and prepare an internship report. As End-Semester Examination, evaluation of the student will be based on the quality of report submitted, presentation skills and their response in the Q/A session by the examiners. The internship report carries 30 marks, seminar of 10 marks, and Q/A 10 marks.

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SEMESTER–VIII

INTERNET TECHNOLOGY AND PROTOCOLS

M. Marks: 100 **Credits**
Time: 3 Hours **L-T-P**
4-0-0

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 Outcomes:
1. To gain knowledge of the meaning, motivation and history of the Internet
2. To understand the access technologies at the consumer end
3. In-depth understanding of the TCP/IP layers
4. Awareness of the Internet Governance

SECTION-A

Internet: A Network Of Networks, Global Virtual Network, Routers and Hosts, Ownership, Internet Service Providers; A Brief History of the Internet: Motivation And Beginnings, The Incredible Growth;
Access Technologies For The Last Mile - Dial-up Internet, Narrowband And Broadband, Leased Data Circuit, Digital Subscriber Line (DSL), Cable Modem, Wireless Technologies, Cellular Wireless Access (4G and 5G);
Protocols (an agreement for communication between devices): International Organizations for Protocols and Standards; The Internet Protocol (IP): software to create a virtual network, IP Addresses: Public/Private, Permanent/Temporary, Static/Dynamic; Network Address Translation (NAT); IPv4/IPv6 Addresses; Global IP Address Allocation; IP Routing, Internet Protocol Security (IPSec)

SECTION-B

The Map of the Internet: Border Gateway Protocol (BGP) – Peering and Transit, Internet Exchange Points (IXP); Transport Protocols: User Datagram Protocol (UDP), Transmission Control Protocol (TCP), Quick UDP Internet Connections (QUIC).
TCP/IP layers and protocols: FTP, DHCP, SSL and Transport layer Security, Email Protocols, Secure Shell and Telnet, ICMP and IGMP;

SECTION-C

TCP/IP tools: wireshark, tcpdump, ip, netcat
Domain Name System – client, server, databases; DNS protocol, DNS performance, DNS based content distribution networks, spam prevention, DNS commands; Case Study: BIND and DHCP

SECTION-D

Layers of the Internet: Social layer, content layer, application layer, logical layer, infrastructure layer
Who Controls the Internet? Internet Governance -
Infrastructural Layer: Internet Engineering Task Force (IETF), Internet Research Task Force (IRTF), Internet Architecture Board (IAB), Internet Society (ISOC), Internet Corporation for Assigned Names and Numbers (ICANN), Institute of Electrical and Electronics Engineers (IEEE);
Logical Layer: International Telecommunication Union (ITU)
Content and Application Layer: Internet Governance Forum (IGF)
Social Layer

Recommended books and Materials:

1. Douglas E. Comer, The Internet Book Everything You Need to Know about Computer Networking and How the Internet Works, Fifth Edition, Taylor & Francis
2. How the internet really works - an illustrated guide to protocols, privacy, censorship, and governance, No Starch Press, 2021
3. Richard Fox, Wei Hao, Internet Infrastructure: Networking, Web Services, and Cloud Computing, CRC Press

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SEMESTER–VIII

TECHNOLOGY & ETHICS

M. Marks: 100 **Credits**
Time: 3 Hours **L-T-P**
4-0-0

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 Outcomes:
1. Understand key ethical theories and their application to technology.
2. Analyze the ethical implications of various technologies.
3. Evaluate case studies involving ethical dilemmas in technology.
4. Develop informed opinions on technology-related ethical issues.
5. Propose ethical frameworks for technology design and implementation.

SECTION- A
Understanding Ethics: Definition and importance of ethics, Key ethical theories: Utilitarianism, deontology, virtue ethics, The role of ethics in technology
The Impact of Technology on Society: Overview of technological advancements (AI, IoT, biotechnology), How technology shapes social interactions and behaviors, Positive and negative effects of technology on society
Privacy and Surveillance: Ethical considerations of data collection and surveillance, The balance between security and privacy, Case studies on privacy violations (e.g., Cambridge Analytica)

SECTION- B
Overview of emerging technologies: Artificial Intelligence and Machine Learning
Artificial Intelligence and Machine Learning, Ethical concerns in AI development and deployment, Bias and fairness in algorithms, Autonomous systems and accountability
Cybersecurity and Ethical Hacking: Understanding ethical hacking vs. malicious hacking, Responsibilities of cybersecurity professionals, Ethical dilemmas in data breaches and vulnerability disclosures

SECTION- C
Technology and Labour: The impact of automation on jobs and the workforce, Ethical considerations of job displacement, Future of work in a tech-driven economy
Environmental Ethics and Technology: The role of technology in environmental sustainability, Ethical implications of e-waste and resource depletion
Social Media and Communication Ethics: The ethical responsibilities of social media platforms, Misinformation, hate speech. Case studies on social media ethics (e.g., misinformation during elections

SECTION- D
Intellectual Property and Technology: Understanding copyright, patents, and trademarks, Ethical considerations in software piracy and content sharing, Balancing innovation with intellectual property rights
Ethics in Technology Policy and Regulation: The role of government and organizations in regulating technology, Ethical frameworks for technology policy development, International considerations in technology ethics
Designing Ethical Technology: Principles of ethical design and development, User-centered design and its ethical implications, Case studies on ethical technology design (e.g., accessibility)

Recommended books:

1. Herman T. Tavani**,** Ethics and Technology: Controversies, Questions, and Strategies for Ethical Computing
2. David J. Morrow, The Ethics of Technology: A Geographical Perspective
3. Michael Negnevitsky, Artificial Intelligence: A Guide to Intelligent Systems (relevant chapters on ethics)
4. Subhash Chandra and M. C. Jain, Artificial Intelligence and Ethics
5. R. V. S. Suryanarayana, Technology and Ethics: A Global Perspective
6. Pavan Duggal, Cyber Law and Ethics

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SEMESTER–VIII
CROSS-PLATFORM MOBILE APPLICATION DEVELOPMENT

M. Marks: 75 **Credits**
Time: 3 Hours **L-T-P**
3-0-0

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 Outcomes:

1. Understand the fundamentals of mobile application development.
2. Utilize cross-platform frameworks for mobile app development.
3. Implement responsive design principles for mobile applications.
4. Test and debug mobile applications across different platforms.
5. Deploy mobile applications to app stores.

SECTION-A

Overview of Mobile Application Development: Types of mobile applications: Native, hybrid, and cross-platform; Advantages and challenges of cross-platform development; Overview of mobile operating systems (iOS, Android)**;** Importance of user interface (UI) and user experience (UX) design, Responsive design principles for mobile apps, Design guidelines for iOS and Android platforms

Cross-Platform Frameworks: Introduction to popular cross-platform frameworks (React Native, Flutter, Xamarin), Comparison of frameworks based on performance, usability, and community support, Setting up the development environment for cross-platform development

SECTION-B

Building Mobile Applications- Getting Started with React Native; Setting up a React Native development environment; Creating a basic React Native application; Understanding components, state, and props; Navigation and routing; Working with APIs and fetching data;

SECTION-C

Using third-party libraries and packages. State management; Working with local and remote data(SQLite, REST APIs);

Testing and Debugging: Importance of testing in mobile app development, Unit testing and widget testing in React Native, Debugging techniques and tools

SECTION-D

Deployment and App Store Submission: Preparing mobile applications for deployment, Building and packaging apps for iOS and Android, Understanding app store guidelines and submission processes

Performance Optimization: Techniques for optimizing the performance of cross-platform apps, Reducing app size and improving load times, Profiling and monitoring app performance

Recommended Books:

1. Adam Boduch, Roy Derks, Mikhail Sakhniuk, React and React Native - Fourth Edition: Build cross-platform JavaScript applications with native power for the web, desktop, Packt Publishing
2. R. R. Sharma, Cross-Platform Mobile Application Development
3. M. R. Gupta, Mobile App Development with Flutter
4. Flutter for Beginners, Alok K. Sahu
5. Dr Rajapraveen K N, Cross Platform Application Development

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SEMESTER–VIII
LAB-1 BASED ON CROSS-PLATFORM MOBILE DEVELOPMENT

M. Marks: 25
Time: 3 Hours

Credits
L-T-P
0-0-1
Lab (2h/week)

Instructions for the examiners: -
Two questions of equal marks strictly as per the syllabus and based on the practical exercises covered in the semester. Questions may be subdivided into parts (not exceeding four). Candidates will attempt ONE question, explain their answer by writing on the answer sheet, and then implement the same on the computer. Examiner will evaluate both the answers (theory as well as practical). The viva will also be conducted one-on-one alongside, and the student asked viva questions related to the question and the solution he/she is working on during the exam.

Lab Exercises based on:

- Setting Up Development Environment: Install and configure React Native for cross-platform development.
- Basic App Creation: Build a simple app using components, state, and props.
- UI Design and Responsive Layout: Create a responsive UI with essential components like buttons, text inputs, and images.
- Navigation Between Screens: Implement basic navigation with multiple screens using React Navigation.
- Fetching Data from APIs: Connect to a REST API, fetch data, and display it in the app.
- Local Data Storage: Store and retrieve data locally using SQLite.
- Basic State Management: Manage state across components with Context API.
- Testing and Debugging: Conduct basic testing and explore debugging tools in React Native.
- App Packaging for Deployment: Prepare and package the app for Android/iOS deployment.

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SEMESTER–VIII

MACHINELEARNING

M. Marks: 75 **Credits**
Time: 3 Hours **L-T-P**
3-0-0

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 Outcomes:

1. Understand key concepts and terminology in machine learning.
2. Apply supervised and unsupervised learning algorithms to datasets.
3. Evaluate and optimize machine learning models.
4. Utilize machine learning libraries and tools for implementation.
5. Analyze real-world problems and propose machine learning solutions.

SECTION-A

Introduction to Machine Learning, Definition and history of machine learning, Types of machine learning: Supervised, unsupervised, and reinforcement learning, Applications of machine learning in various fields

Key Concepts and Terminology: Features, labels, training, and testing datasets, Overfitting vs. underfitting, Bias-variance tradeoff

SECTION-B

Data Pre-processing: Importance of data pre-processing, Techniques: Data cleaning, normalization, and transformation, Handling missing data and categorical variables

Supervised Learning: Regression Algorithms: Linear regression: Theory and implementation, Evaluation metrics: Mean squared error, R^2 score, Regularization techniques: Lasso and Ridge regression

SECTION-C

Supervised Learning: **Classification Algorithms-** Logistic regression and its applications, Decision trees and random forests, **Model Evaluation and Selection:** Train-test split and cross-validation, Confusion matrix and classification metrics (precision, recall, F1 score), Hyperparameter tuning and model selection techniques

SECTION-D

Dimensionality Reduction: Introduction to dimensionality reduction techniques, Principal component analysis (PCA)

Unsupervised Learning- Clustering Algorithms: K-means clustering: Theory and implementation, Hierarchical clustering and DBSCAN, Evaluation of clustering results

Recommended Books:

1. Christopher M. Bishop, Pattern Recognition and Machine Learning
2. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow
3. Tom Mitchell, Machine Learning, McGraw Hill
4. Kamalkant Hiran, Dr. Ruchi Doshi, Ritesh Kumar Jain, Dr. Kamlesh Lakhwani. Machine Learning, BPB publications.
5. Dr. Amit Dua and Umair Ayub, Beginning with Machine Learning, BPB publications.
6. Saikat Dutt , Subramanian Chandramouli , Amit Kumar Das, Machine Learning, Pearson Education
7. Vinod Chandra , Anand Hareendran S., Machine Learning : A Practitioner's Approach, PHI Learning

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SEMESTER–VIII
LAB-2 BASED ON MACHINE LEARNING

M. Marks: 25
Time: 3 Hours

Credits
L-T-P
0-0-1
Lab (2h/week)

Instructions for the examiners: -
Two questions of equal marks strictly as per the syllabus and based on the practical exercises covered in the semester. Questions may be subdivided into parts (not exceeding four). Candidates will attempt ONE question, explain their answer by writing on the answer sheet, and then implement the same on the computer. Examiner will evaluate both the answers (theory as well as practical). The viva will also be conducted one-on-one alongside, and the student asked viva questions related to the question and the solution he/she is working on during the exam.

Lab Exercises based on:

- Understanding Machine Learning Concepts: Explore and define key concepts in machine learning, including features, labels, and the types of learning (supervised, unsupervised).
- Data Pre-processing: Perform data cleaning, normalization, and handling of missing values in a given dataset.
- Implementing Linear Regression: Build a linear regression model, compute evaluation metrics (MSE, R^2), and interpret the results.
- Logistic Regression Application: Develop a logistic regression model for binary classification and evaluate its performance.
- Decision Trees and Model Evaluation: Create a decision tree model and utilize techniques such as train-test split and cross-validation to assess its accuracy.
- Hyperparameter Tuning: Apply hyperparameter tuning techniques (e.g., grid search) to improve model performance on selected algorithms.
- Dimensionality Reduction with PCA: Implement Principal Component Analysis (PCA) on a dataset and visualize the impact of dimensionality reduction.
- K-means Clustering: Conduct K-means clustering on a dataset, visualize the clusters, and evaluate the clustering results.

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SEMESTER–VIII

DATA VISUALIZATION
(Minor-2 Theory)

M. Marks: 75 **Credits**
Time: 3 Hours **L-T-P**
3-0-0

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 Outcomes:

1. understanding of data visualisation and key terms.
2. skills on creating visual representation of data.
3. develop insights how Tableau is better than excel.
4. using interactive data visualisation.

SECTION–A

Introduction: Data Visualisation ,Importance of data visualisation, Advantages and Disadvantages of Data Visualisation, Applications of data Visualisation. Data analysis Definition, data analysis process, sensitivity analysis with data tables in excel, summarizing data with data functions, optimization with excel solver.

SECTION–B

Types of Data Visualisation Techniques (Charts, Plots, Maps) Correlation and Regression coefficients ,visualisation of correlation and regression coefficients. Tools for visualisation of Data ,Tableau basic overview, tableau installation, tableau data types ,working with different Visualisation in Tableau.

SECTION–C

Visualising Data process: acquiring and processing Dataset.Quick Table calculation: Running Total ,Moving average, Filtering, Multiple Measures, Boolean and Numerical Formulas. Dashboard Development :Layout , Dashboard Sizzling ,Titles ,Formatting. Tableau Public and Desktop: Copy ,Export, Print , Print screen .

SECTION–D

Interactive Data Visualisation: Drawing with data ,scales ,axes, updates. Transition and motion. Common pitfalls of colour use, Visualisation along Linear axis ,visualisation along logarithmic axes.

Recommended Books:

1. Kavitha Ranganathan, Impactful Data Visualization: Hide and Seek with Graphs, Penguin Random House India Private Limited 2023
2. Purna Chander Rao. Kathula, Hands-on Data Analysis & Visualization with Pandas, BPB Publications
3. Claus O. Wilke, Fundamentals of Data Visualization, ORielly, available at https://clauswilke.com/dataviz/
4. Jeffrey Ohlmann,Michael Fry, Data Visualization: Exploring And Explaining With Data By Cengage Learning
5. Dunlop, Dorothy D., and Ajit C. Tamhane, “Statistics and data analysis: from elementary to intermediate”, Prentice Hall, 2000.
6. Joseph F Hair, William C Black et. al , Multivariate Data Analysis, Pearson Education,7th edition, 2013.

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SEMESTER–VIII

LAB-3 BASED ON DATA VISUALIZATION
(Minor-2 Practical)

M. Marks: 25
Time: 3 Hours

Credits
L-T-P
0-0-1
Lab (2h/week)

Instructions for the examiners: -
Two questions of equal marks strictly as per the syllabus and based on the practical exercises covered in the semester. Questions may be subdivided into parts (not exceeding four). Candidates will attempt ONE question, explain their answer by writing on the answer sheet, and then implement the same on the computer. Examiner will evaluate both the answers (theory as well as practical). The viva will also be conducted one-on-one alongside, and the student asked viva questions related to the question and the solution he/she is working on during the exam.

Lab exercises based on:

- Work with a simple dataset to create visualizations that show relationships within data (using basic tools like Excel or Google Sheets).
- Understanding Data Types and Visual Encoding:
- Work with datasets containing categorical, numerical, time series, and geospatial data types.
- Identify suitable visual encodings (e.g., color, shape, size) based on data types.
- Practice encoding categorical and numerical data, with exercises in visualizing data along both linear and logarithmic scales.
- Create basic visualizations (e.g., bar chart, line chart) using sample data on both linear and logarithmic scales.
- Experiment with both types of scales in a tool like Python's Matplotlib or Excel, exploring data that covers wide-ranging values.