

**Kurukshetra University, Kurukshetra**  
(Established by the State Legislature Act XII of 1956)  
(‘A++’ Grade, NAAC Accredited)

॥ योगस्थः कुरु कर्माणि ॥  
समबुद्धिं व योग युक्त होकर कर्म करो  
(Perform Actions while Stead fasting in the State of Yoga)



Modified Scheme of Examination (5<sup>th</sup> and 6<sup>th</sup> Semester) for Under-  
Graduate Programmes  
**Bachelor of Vocation (B.Voc.) (SOFTWARE DEVELOPMENT):**  
**SCHEME D**  
according to  
Curriculum Framework for Under-Graduate Programmes  
As per NEP-2020 (Multiple Entry-Exit, Internships and Choice Based  
Credit System)  
**DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS**  
(For the Batches Admitted From 2023-2024)

**Kurukshetra University Kurukshetra**  
**Modified Scheme of Examination (5<sup>th</sup> and 6<sup>th</sup> Semester) for Undergraduate programmes**  
**Subject: B.Voc. (Software Development)**  
**According to**  
**Curriculum Framework for Undergraduate Programmes**  
**as per NEP 2020 (Multiple Entry-Exit, Internships, and Choice Based Credit System)**

| Sem | Course Type | Course Code               | Nomenclature of paper           | Credits | Contact hours | Internal marks | End term Marks | Total Marks | Duration of exam (Hrs) T + P |
|-----|-------------|---------------------------|---------------------------------|---------|---------------|----------------|----------------|-------------|------------------------------|
| 5   | CC-A5       | B23-CSD-501               | Software Engineering            | 3       | 3             | 20             | 50             | 70          | 3                            |
|     |             |                           | Practical                       | 1       | 2             | 10             | 20             | 30          | 3                            |
|     | CC-B5       | B23- CSD-502              | Back-end Development            | 3       | 3             | 20             | 50             | 70          | 3                            |
|     |             |                           | Practical                       | 1       | 2             | 10             | 20             | 30          | 3                            |
|     | CC-C5       | B23- CSD -503             | Computer Graphics               | 3       | 3             | 20             | 50             | 70          | 3                            |
|     |             |                           | Practical                       | 1       | 2             | 10             | 20             | 30          | 3                            |
|     | CC-M5(V)    | To be taken from VOC Pool |                                 |         |               |                |                |             |                              |
|     | SEC-4       | Internship @ 4 Credits    |                                 |         |               |                |                |             |                              |
| 6   | CC-A6       | B23- CSD -601             | Programming using Python        | 3       | 3             | 20             | 50             | 70          | 3                            |
|     |             |                           | Practical                       | 1       | 2             | 10             | 20             | 30          | 3                            |
|     | CC-B6       | B23- CSD -602             | Advanced Web Development        | 3       | 3             | 20             | 50             | 70          | 3                            |
|     |             |                           | Practical                       | 1       | 2             | 10             | 20             | 30          | 3                            |
|     | CC-C6       | B23- CSD -603             | Mobile App Development          | 3       | 3             | 20             | 50             | 70          | 3                            |
|     |             |                           | Practical                       | 1       | 2             | 10             | 20             | 30          | 3                            |
|     | CC-M6       | B23- CSD -604             | Introduction to Design Thinking | 3       | 3             | 20             | 50             | 70          | 3                            |
|     |             |                           | Practical                       | 1       | 2             | 10             | 20             | 30          | 3                            |
|     | CC-M7(V)    | To be taken from VOC Pool |                                 |         |               |                |                |             |                              |

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Syllabus of Examination (5<sup>th</sup> & 6<sup>th</sup> Semester) for Under-Graduate Programmes  
**Bachelor of Vocation (B.Voc.(Software Development))**  
**Scheme D**  
according to  
Curriculum Framework for Under-Graduate Programmes  
As per NEP-2020 (Multiple Entry-Exit, Internships and Choice Based Credit System)  
**DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS**  
(For the Batches Admitted From 2023-2024)

**DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS**  
**KURUKSHETRA UNIVERSITY, KURUKSHETRA**

| Scheme: 2023-24, Syllabus: 2025-26                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                     |                           |       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------|
| Part A - Introduction                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                     |                           |       |
| Subject                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | B.Voc.(Software Development)                                                                                                                                                                                                                                                                                                                        |                           |       |
| Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | V                                                                                                                                                                                                                                                                                                                                                   |                           |       |
| Name of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Software Engineering                                                                                                                                                                                                                                                                                                                                |                           |       |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | B23-CSD-501                                                                                                                                                                                                                                                                                                                                         |                           |       |
| Course Type:<br>(CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | CC-A5                                                                                                                                                                                                                                                                                                                                               |                           |       |
| Level of the course (As per Annexure-I                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 300-399                                                                                                                                                                                                                                                                                                                                             |                           |       |
| Pre-requisite for the course (if any)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Knowledge of any Programming language                                                                                                                                                                                                                                                                                                               |                           |       |
| Course Learning Outcomes(CLO):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | After completing this course, the learner will be able to:<br>1. learn the various models for software development.<br>2. understand how to analyze software.<br>3. plan a software design and the risks associated with software.<br>4. test and validate software<br>5*. Implement the various tools and techniques used in software engineering. |                           |       |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Theory                                                                                                                                                                                                                                                                                                                                              | Practical                 | Total |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3                                                                                                                                                                                                                                                                                                                                                   | 1                         | 4     |
| Contact Hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3                                                                                                                                                                                                                                                                                                                                                   | 2                         | 5     |
| Max. Marks:100(70(T)+30(P))<br>Internal Assessment Marks:30(20(T)+10(P))<br>End Term Exam Marks: 70(50(T)+20(P))                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                     | Time: 3 Hrs.(T), 3Hrs.(P) |       |
| Part B- Contents of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                     |                           |       |
| <u>Instructions for Paper-Setter</u><br>The examiner will set a total of nine questions. Out of which first question will be compulsory. Remaining eight questions will be set from four unit selecting two questions from each unit. The examination will be of three-hour duration. All questions will carry equal marks. The first question will comprise short answer-type questions covering the entire syllabus.<br>Candidate will have to attempt five questions in all, selecting one question from each unit. First question will be compulsory.<br>The practicum will be evaluated by an external and an internal examiner. The examination will be of |                                                                                                                                                                                                                                                                                                                                                     |                           |       |

three-hour duration.

| Unit | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Contact Hours |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| I    | Introduction: Program vs. Software, Software Engineering, Programming paradigms, Software Crisis – problem and causes, Phases in Software development: Requirement Analysis, Software Design, Coding, Testing, Maintenance, Software Development Process Models: Waterfall, Prototype, Evolutionary and Spiral models, Role of Metrics.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 11            |
| II   | Feasibility Study, Software Requirement Analysis and Specifications: SRS, Need for SRS, Characteristics of an SRS, Components of an SRS, Problem Analysis, Information gathering tools, Requirement specification, validation and metrics.<br>Structured Analysis and Tools: Data Flow Diagram, Data Dictionary, Decision table, Decision trees, Structured English, Entity-Relationship diagrams                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 11            |
| III  | Software Project Planning: Cost estimation: COCOMO model, Project scheduling, Staffing, and personnel planning, team structure, Software configuration management, Quality assurance plans, Project monitoring plans, Risk Management.<br>Software Design: Design fundamentals, problem partitioning, and abstraction, design methodology, Cohesion & Coupling.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 12            |
| IV   | Software testing strategies: unit testing, integration testing, Validation testing, System testing, Alpha and Beta testing.<br>Software Maintenance: Type of maintenance, Management of Maintenance, Maintenance Process, maintenance characteristics.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 11            |
| V*   | Practicum:<br>Students are advised to do laboratory/practical practice not limited to but including the following types of problems: <ul style="list-style-type: none"> <li>• Development of 0-level DFD</li> <li>• Development of 1 level DFD</li> <li>• Development of 2-level DFD</li> <li>• data dictionary,</li> <li>• E-R diagram for Student Teacher Relationship</li> <li>• E-R diagram for Library Management,</li> <li>• Draw an ER Diagram for the Hospital Management System.</li> <li>• ER diagram for (ANY 5) <ul style="list-style-type: none"> <li>• Student Result Management System</li> <li>• Library management system</li> <li>• Inventory control system</li> <li>• Accounting system</li> <li>• Fast food billing system</li> <li>• Bank loan system</li> <li>• Blood bank system</li> <li>• Railway reservation system</li> <li>• Automatic teller machine</li> <li>• Video library management system</li> <li>• Hotel management system</li> <li>• Hostel management system</li> </ul> </li> </ul> | 30            |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                 |                                                                                                                                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <ul style="list-style-type: none"> <li>• E-ticking</li> <li>• Share online trading</li> <li>• Hostel management system</li> <li>• Resource management system</li> <li>• Court case management system</li> </ul> |                                                                                                                                           |
| <b>Suggested Evaluation Methods</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                 |                                                                                                                                           |
| <b>Internal Assessment:</b> <ul style="list-style-type: none"> <li>➤ <b>Theory</b> <ul style="list-style-type: none"> <li>• Class Participation: 5</li> <li>• Seminar/presentation/assignment/quiz/class test etc.: 5</li> <li>• Mid-Term Exam: 10</li> </ul> </li> <li>➤ <b>Practicum</b> <ul style="list-style-type: none"> <li>• Class Participation: NA</li> <li>• Seminar/Demonstration/Viva-voce/Lab records etc.: 10</li> <li>• Mid-Term Exam: NA</li> </ul> </li> </ul>                 |                                                                                                                                                                                                                 | <b>End-Term Examination:</b><br>A three-hour exam for both theory and practicum.<br><b>End Term Exam Marks:</b><br><b>70(50(T)+20(P))</b> |
| <b>Part C-Learning Resources</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                 |                                                                                                                                           |
| <b>Recommended Books/e-resources/LMS:</b> <ul style="list-style-type: none"> <li>• Pressman R. S., “Software Engineering – A Practitioner’s Approach”, Tata McGraw Hill.</li> <li>• Jalote P., “An Integrated Approach to Software Engineering”, Narosa.</li> <li>• Sommerville, “Software Engineering”, Addison Wesley.</li> <li>• Fairley R., “Software Engineering Concepts”, Tata McGraw Hill.</li> <li>• James Peter, W Pedrycz, “Software Engineering”, John Wiley &amp; Sons.</li> </ul> |                                                                                                                                                                                                                 |                                                                                                                                           |

\*Applicable for courses having practical components.

**DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS**  
**KURUKSHETRA UNIVERSITY, KURUKSHETRA**

| Scheme: 2023-24, Syllabus: 2025-26                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                               |                           |       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------|
| Part A - Introduction                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                               |                           |       |
| Subject                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | B.Voc.(Software Development)                                                                                                                                                                                                                                                                                                                                                                                  |                           |       |
| Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | V                                                                                                                                                                                                                                                                                                                                                                                                             |                           |       |
| Name of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Back-end Development                                                                                                                                                                                                                                                                                                                                                                                          |                           |       |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | B23-CSD-502                                                                                                                                                                                                                                                                                                                                                                                                   |                           |       |
| Course Type:<br>(CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | CC-B5                                                                                                                                                                                                                                                                                                                                                                                                         |                           |       |
| Level of the course (As per Annexure-I                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 300-399                                                                                                                                                                                                                                                                                                                                                                                                       |                           |       |
| Pre-requisite for the course (if any)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Basics of Web-Development and DBMS                                                                                                                                                                                                                                                                                                                                                                            |                           |       |
| Course Learning Outcomes(CLO):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | After completing this course, the learner will be able to:<br><div>1. Understand the principles of back-end development.</div> <div>2. Gain proficiency in back-end programming languages and frameworks.</div> <div>3. Learn to design and manage databases.</div> <div>4. Develop skills to create and use back-end applications.</div> <div>5*. to equip with the knowledge of back-end programming.</div> |                           |       |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Theory                                                                                                                                                                                                                                                                                                                                                                                                        | Practical                 | Total |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3                                                                                                                                                                                                                                                                                                                                                                                                             | 1                         | 4     |
| Contact Hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 3                                                                                                                                                                                                                                                                                                                                                                                                             | 2                         | 5     |
| Max. Marks:100(70(T)+30(P))<br>Internal Assessment Marks:30(20(T)+10(P))<br>End Term Exam Marks: 70(50(T)+20(P))                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                               | Time: 3 Hrs.(T), 3Hrs.(P) |       |
| Part B- Contents of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                               |                           |       |
| <p style="text-align: center;"><b><u>Instructions for Paper-Setter</u></b></p> <p>The examiner will set a total of nine questions. Out of which first question will be compulsory. The remaining eight questions will be set from four units selecting two questions from each unit. The examination will be of three-hour duration. All questions will carry equal marks. The first question will comprise short answer-type questions covering the entire syllabus. The candidate must attempt five questions, selecting one from each unit. The first question will be compulsory.</p> |                                                                                                                                                                                                                                                                                                                                                                                                               |                           |       |

The practicum will be evaluated by an external and an internal examiner. The examination will be of three-hour duration.

| Unit | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Contact Hours |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| I    | <b>Introduction to back-end Development:</b> Overview of backend, Client-server architecture, Introduction to web servers and database<br><b>Programming Languages and Tools:</b> Introduction to server-side languages (e.g., Node.js), Syntax and semantics of chosen server-side language                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 11            |
| II   | <b>Programming Languages:</b> Version control with Git, Introduction to IDEs (Integrated Development Environments) of chosen language, Writing and executing basic server-side scripts<br><b>Performance Optimization and Security:</b> Caching strategies, Query optimization                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 11            |
| III  | <b>Database Management:</b> Introduction to databases and DBMS (SQL and NoSQL), Designing a database schema, CRUD operations (Create, Read, Update, Delete), Connecting applications to a database                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 11            |
| IV   | <b>Server-Side Frameworks:</b> Overview of popular server-side frameworks (e.g., Express.js), Building a simple application using a framework.<br><b>API Development:</b> RESTful API concepts, Designing and documenting APIs, Authentication and authorization basics<br>Web security best practices (SQL injection, XSS, CSRF)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 12            |
| V*   | The following activities be carried out/ discussed in the lab during the initial period of the semester.<br>Programming Lab: <ul style="list-style-type: none"> <li>• Introduction to Backend Technologies: Objective: Familiarize students with backend technologies and tools.               <ul style="list-style-type: none"> <li>○ Setup development environment (e.g., IDE, Git).</li> <li>○ Create a simple “Hello World” backend application in Node.js.</li> </ul> </li> <li>• Working with Databases (SQL): Objective: Learn basic SQL operations and database interactions.               <ul style="list-style-type: none"> <li>○ Set up MySQL/PostgreSQL database.</li> <li>○ Perform CRUD operations using SQL queries (Create, Read, Update, Delete).</li> </ul> </li> <li>• Working with NoSQL Databases: Objective: Introduce students to NoSQL databases.               <ul style="list-style-type: none"> <li>○ Set up MongoDB database.</li> <li>○ Implement CRUD operations using NoSQL commands.</li> </ul> </li> <li>• Building RESTful APIs: Objective: Develop skills in designing and implementing RESTful APIs.               <ul style="list-style-type: none"> <li>○ Create endpoints for CRUD operations.</li> </ul> </li> </ul> | 30            |



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                         |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <ul style="list-style-type: none"> <li>○ Implement basic authentication and authorization.</li> <li>• Web Frameworks (Choose one: Node.js or Express.js): Objective: Gain practical experience with backend frameworks. <ul style="list-style-type: none"> <li>○ Setup Node.js/Express.js project.</li> <li>○ Implement a simple web application (Express.js or Node.js).</li> </ul> </li> <li>• Integrating Frontend and Backend: Objective: Understand frontend-backend interaction. <ul style="list-style-type: none"> <li>○ Create API endpoints to serve JSON data.</li> <li>○ Develop a frontend (HTML/CSS/JavaScript) to consume backend API.</li> </ul> </li> <li>• Data Validation and Error Handling: Objective: Learn techniques for validating input data and handling errors. <ul style="list-style-type: none"> <li>○ Implement input validation using middleware (Express.js) or Node.js forms.</li> <li>○ Handle errors and exceptions gracefully.</li> </ul> </li> <li>• Security Best Practices: Objective: Implement security measures in backend applications. <ul style="list-style-type: none"> <li>○ Implement HTTPS/SSL configuration.</li> <li>○ Prevent common security vulnerabilities (e.g., SQL injection, XSS).</li> </ul> </li> </ul> |                                                                                         |
| <b>Suggested Evaluation Methods</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                         |
| <b>Internal Assessment:</b> <ul style="list-style-type: none"> <li>➤ <b>Theory</b> <ul style="list-style-type: none"> <li>• Class Participation: 5</li> <li>• Seminar/presentation/assignment/quiz/class test etc.:5</li> <li>• Mid-Term Exam: 10</li> </ul> </li> <li>➤ <b>Practicum</b> <ul style="list-style-type: none"> <li>• Class Participation: NA</li> <li>• Seminar/Demonstration/Viva-voce/Lab records etc.:10</li> <li>• Mid-Term Exam: NA</li> </ul> </li> </ul>                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>End Term Examination:</b><br><b>A three-hour exam for both theory and practicum.</b> |
| <b>Part C-Learning Resources</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                         |
| <b>Recommended Books/e-resources/LMS:</b> <ul style="list-style-type: none"> <li>• "Node.js Design Patterns" by Mario Casciaro and Luciano Mammino</li> <li>• "Learning PHP, MySQL &amp; JavaScript" by Robin Nixon</li> <li>• Online documentation and tutorials for the chosen programming language and frameworks</li> <li>• "Clean Code: A Handbook of Agile Software Craftsmanship" by Robert C. Martin</li> <li>• "Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems" by Martin Kleppmann</li> <li>• "SQL Cookbook: Query Solutions and Techniques for Database Developers" by Anthony Molinaro</li> <li>• "High-Performance Browser Networking: What every web developer should know about networking and web performance" by Ilya Grigorik</li> </ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                         |

\*Applicable for courses having practical component.

**DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS**  
**KURUKSHETRA UNIVERSITY, KURUKSHETRA**

| Scheme: 2023-24, Syllabus: 2024-25                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                           |       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------|
| Part A - Introduction                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                           |       |
| Subject                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | B.Voc.(Software Development)                                                                                                                                                                                                                                                                                                                                                                                                                        |                           |       |
| Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | V                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                           |       |
| Name of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Computer Graphics                                                                                                                                                                                                                                                                                                                                                                                                                                   |                           |       |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | B23-CSD-503                                                                                                                                                                                                                                                                                                                                                                                                                                         |                           |       |
| Course Type:<br>(CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | CC-C5                                                                                                                                                                                                                                                                                                                                                                                                                                               |                           |       |
| Level of the course (As per Annexure-I                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 300-399                                                                                                                                                                                                                                                                                                                                                                                                                                             |                           |       |
| Pre-requisite for the course (if any)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Basic Knowledge of computer                                                                                                                                                                                                                                                                                                                                                                                                                         |                           |       |
| Course Learning Outcomes(CLO):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | After completing this course, the learner will be able to:<br>1. understand the concepts of computer graphics<br>2. learn and implement point, line, and circle drawing algorithms.<br>3. acquire knowledge of two-dimensional transformations and line clipping algorithms.<br>4. understand 3-D graphics concepts and acquire skills for designing 3-D graphics<br><br>5*. to design programs based on theoretical concepts of Computer Graphics. |                           |       |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Theory                                                                                                                                                                                                                                                                                                                                                                                                                                              | Practical                 | Total |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1                         | 4     |
| Contact Hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 2                         | 5     |
| Max. Marks:100(70(T)+30(P))<br>Internal Assessment Marks:30(20(T)+10(P))<br>End Term Exam Marks: 70(50(T)+20(P))                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Time: 3 Hrs.(T), 3Hrs.(P) |       |
| <b><u>Instructions for Paper-Setter</u></b><br>The examiner will set a total of nine questions. Out of which first question will be compulsory. Remaining eight questions will be set from four unit selecting two questions from each unit. The examination will be of three-hour duration. All questions will carry equal marks. The first question will comprise short answer-type questions covering the entire syllabus.<br>The candidate must attempt five questions in all, selecting one question from each unit. The first question will be compulsory.<br>The practicum will be evaluated by an external and an internal examiner. The examination will be of three-hour duration. |                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                           |       |

| Part B- Contents of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Contact Hours                                                                                                          |
| I                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Introduction:</b> History of Computer Graphics (CG), Applications of Computer Graphics, Components of interactive graphics systems<br><b>Display devices:</b> Refresh CRT, Color CRT, Plasma Panel displays LCD Panels, Raster-scan System, Random scan System, Graphic software, Input/Output Devices, Tablets                                                                                                                                                                                                                                                                                                                                                                                                               | 11                                                                                                                     |
| II                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Output Primitives:</b> Points and Lines, Line Drawing Algorithms: DDA algorithm, Bresenham's algorithm,<br><b>Circle drawing Algorithms:</b> Polynomial Method, Bresenham's algorithm. Parametric representation of Cubic Curves, Bezier Curves                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 11                                                                                                                     |
| III                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>2D Transformation:</b> Use of Homogeneous Coordinates Systems, Composite Transformation: Translation, Scaling, Rotation, Mirror Reflection, Rotation about an Arbitrary Point. Clipping and Windowing, Clipping Operations.<br><b>Line Clipping Algorithms:</b> The Mid-Point subdivision method, Cohen-Sutherland Line Clipping Algorithms, Polygon Clipping, Sutherland Hodgeman Algorithms, Text Clipping.                                                                                                                                                                                                                                                                                                                 | 12                                                                                                                     |
| IV                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>3-D Graphics:</b> 3-D object representations, 3-D Transformations: Translation, Rotation, Scaling, Projections, <b>Hidden surface elimination:</b> Back face removal, Depth Buffer algorithm, Scan-line algorithm, Depth sort algorithm, Shading.                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 11                                                                                                                     |
| V*                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | The following activities be carried out/ discussed in the lab during the semester.<br>Programming Lab: <ul style="list-style-type: none"> <li>• Implement DDA line drawing algorithm for all types of slope.</li> <li>• Implement Bresenham's line drawing algorithm for all types of slopes.</li> <li>• Implement Bresenham's Circle drawing algorithm.</li> <li>• Implement Bresenham's Ellipse drawing algorithm.</li> <li>• Implement various 2-D transformations on objects like lines, rectangles, etc.</li> <li>• Implement to clip a line using the Mid-Point subdivision algorithm</li> <li>• Implement to clip a line using Cohen-Sutherland algorithm</li> <li>• Implement 3-D transformations on objects.</li> </ul> | 30                                                                                                                     |
| Suggested Evaluation Methods                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                        |
| <b>Internal Assessment:</b> <ul style="list-style-type: none"> <li>➤ <b>Theory</b> <ul style="list-style-type: none"> <li>• Class Participation: 5</li> <li>• Seminar/presentation/assignment/quiz/class test etc.: 5</li> <li>• Mid-Term Exam: 10</li> </ul> </li> <li>➤ <b>Practicum</b> <ul style="list-style-type: none"> <li>• Class Participation: NA</li> <li>• Seminar/Demonstration/Viva-voce/Lab records etc.: 10</li> <li>• Mid-Term Exam: NA</li> </ul> </li> </ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>End Term Examination:</b><br><b>A three-hour exam for both theory and practicum.</b><br><b>End Term Exam Marks:</b> |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>70(50(T)+20(P))</b> |
| <b>Part C-Learning Resources</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                        |
| <b>Recommended Books/e-resources/LMS:</b> <ul style="list-style-type: none"> <li>• Donald Hearn, M. Pauline Baker, Computer Graphics, Pearson Education.</li> <li>• J. D. Foley, A. Van Dam, S. K. Feiner and J. F. Hughes, Computer Graphics - Principles and Practice, Pearson Education.</li> <li>• Newmann &amp; Sproull, Principles of Interactive Computer Graphics, McGraw Hill.</li> <li>• Rogers, David F., Procedural Elements of Computer Graphics, McGraw Hill.</li> <li>• Zhigang Xiang, Roy Plastock, Computer Graphics, Tata McGraw Hill.</li> </ul> |                        |

\*Applicable for courses having practical components.

**DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS**  
**KURUKSHETRA UNIVERSITY, KURUKSHETRA**

| Scheme: 2023-24, Syllabus: 2024-25                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                       |                           |               |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|---------------|
| Part A - Introduction                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                       |                           |               |
| Subject                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | B.Voc.(Software Development)                                                                                                                                                                                                                                                                                                                                                                                          |                           |               |
| Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | VI                                                                                                                                                                                                                                                                                                                                                                                                                    |                           |               |
| Name of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Programming using Python                                                                                                                                                                                                                                                                                                                                                                                              |                           |               |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | B23-CSD-601                                                                                                                                                                                                                                                                                                                                                                                                           |                           |               |
| Course Type:<br>(CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | CC-A6                                                                                                                                                                                                                                                                                                                                                                                                                 |                           |               |
| Level of the course (As per Annexure-I                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 300-399                                                                                                                                                                                                                                                                                                                                                                                                               |                           |               |
| Pre-requisite for the course (if any)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Knowledge of any Computer Programming Language                                                                                                                                                                                                                                                                                                                                                                        |                           |               |
| Course Learning Outcomes(CLO):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | After completing this course, the learner will be able to:<br><div>1. understand the basic concepts of Python programming</div> <div>2. learn various data structures used in Python programming.</div> <div>3. develop the simple programs of Python using arrays and functions.</div> <div>4. illustrate the process of data file manipulations using python</div> <div>5* develop the programs using Python.</div> |                           |               |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Theory                                                                                                                                                                                                                                                                                                                                                                                                                | Practical                 | Total         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3                                                                                                                                                                                                                                                                                                                                                                                                                     | 1                         | 4             |
| Contact Hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3                                                                                                                                                                                                                                                                                                                                                                                                                     | 2                         | 5             |
| Max. Marks:100(70(T)+30(P))<br>Internal Assessment Marks:30(20(T)+10(P))<br>End Term Exam Marks: 70(50(T)+20(P))                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                       | Time: 3 Hrs.(T), 3Hrs.(P) |               |
| Part B- Contents of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                       |                           |               |
| <b>Instructions for Paper- Setter</b><br>The examiner will set a total of nine questions. Out of which first question will be compulsory. Remaining eight questions will be set from four unit selecting two questions from each unit. Examination will be of three-hour duration. All questions will carry equal marks. First question will comprise of short answer type questions covering entire syllabus.<br>Candidate will have to attempt five questions in all, selecting one question from each unit. First question will be compulsory.<br>Practicum will be evaluated by an external and an internal examiner. Examination will be of three-hour duration. |                                                                                                                                                                                                                                                                                                                                                                                                                       |                           |               |
| Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Topics                                                                                                                                                                                                                                                                                                                                                                                                                |                           | Contact Hours |

|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |    |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| I   | Introduction to Python: Python Interpreter, Python as calculator, Python shell, Indentation, identifier and keywords, literals, strings, Operators: Arithmetic, Relational, Logical, comparison, Bitwise, Assignment, Identity operator and Membership operator; Input & output statements; Control statements: Branching, looping, Conditional statement, Exit function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 11 |
| II  | String Manipulations: Subscript operator, indexing, slicing a string, other functions on strings, string module. Strings and number system: Format functions, converting strings to numbers & Vice Versa. List, Tuples, Sets, Dictionaries: Basic list operators, replacing, inserting, removing an element, searching, Sorting lists, dictionary literals, adding & removing keys, accessing & replacing values, traversing dictionaries.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 11 |
| III | Array in Python, Design with Functions: hiding redundancy, complexity, arguments & return values; Formal/Actual arguments, named arguments, program structure and design, Recursive functions, scope & Global statements, Importing modules, Math modules & Random modules.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 11 |
| IV  | Exception Handling: Exceptions, except clause, try and finally clause, user-defined exceptions.<br>File Handling: Manipulating files & directories, OS & SYS modules, Reading, writing text & numbers from/to file.<br>Graphics: “Turtle” module, drawing colors, shapes, digital images, image file formats.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 12 |
| V*  | <b>Practicum:</b><br>Students are advised to do laboratory/practical practice not limited to but including the following types of problems: <ul style="list-style-type: none"> <li>• WAP to find the roots of a quadratic equation.</li> <li>• WAP to accept a number ‘n’ and (a). Check if ‘n’ is prime (b). Generate all prime numbers till ‘n’ (c). Generate first ‘n’ prime numbers (d). This program may be done using functions.</li> <li>• WAP that accepts a character and performs the following: (a). print whether the character is a letter, numeric digit, or special character (b). if the character is a letter, print whether the letter is uppercase or lowercase (c). if the character is a numeric digit, print its name in the text (e.g., if the input is 9, the output is NINE)</li> <li>• WAP to perform the following operations on a string (a). Find the frequency of a character in a string. (b). Replace a character by another character in a string. (c). Remove the first occurrence of a character from a string. (d). Remove all occurrences of a character from a string.</li> <li>• WAP to swap the first n characters of two strings.</li> <li>• Write a function that accepts two strings and returns the indices of all the occurrences of the second string in the first string as a list. If the second string is not present in the first string, then it should return -1.</li> <li>• WAP to create a list of the cubes of only the even integers appearing in the input list (may have elements of other types also) using the following: (a). 'for' loop (b). list comprehension</li> </ul> | 30 |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <ul style="list-style-type: none"><li>WAP to read a file and (a). Print the total number of characters, words, and lines in the file. (b). Calculate the frequency of each character in the file. Use a variable of dictionary type to maintain the count. (c). Print the words in reverse order. (d). Copy even lines of the file to a file named 'File1' and odd lines to another file named 'File2'.</li><li>Write a function that prints a dictionary where the keys are numbers between 1 and 5 and the values are cubes of the keys.</li><li>Consider a tuple t1= (1, 2, 5, 7, 9, 2, 4, 6, 8, 10). WAP to perform the following operations: (a). Print half the values of the tuple in one line and the other half in the next line. (b). Print another tuple whose values are even numbers in the given tuple. (c). Concatenate a tuple t2= (11,13,15) with t1. (d). Return maximum and minimum values from this tuple</li><li>WAP to accept a name from a user. Raise and handle the appropriate exception(s) if the text entered by the user contains digits and/or special characters.</li></ul> |  |
| <b>Suggested Evaluation Methods</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
| <b>Internal Assessment:</b><br>➤ <b>Theory</b> <ul style="list-style-type: none"><li>Class Participation: 5</li><li>Seminar/presentation/assignment/quiz/class test etc.: 5</li><li>Mid-Term Exam: 10</li></ul> ➤ <b>Practicum</b> <ul style="list-style-type: none"><li>Class Participation: NA</li><li>Seminar/Demonstration/Viva-voce/Lab records etc.: 10</li><li>Mid-Term Exam: NA</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>End-Term Examination:</b> A three-hour exam for both theory and practicum.<br><br><b>End Term Exam Marks:</b> 70(50(T)+20(P))                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |
| <b>Part C-Learning Resources</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
| <b>Recommended Books/e-resources/LMS:</b> <ul style="list-style-type: none"><li>Sheetal Taneja, Naveen Kumar, Python Programming: A Modular approach, 5<sup>th</sup> Impression, Pearson.</li><li>Reema Thareja, Python Programming Using Problem Solving Approach, Oxford University Press.</li><li>Mark Lutz, Learning Python (available online at pdf derive).</li><li>Gutttag John V, Introduction to Computation and Programming Using Python with Application to Understanding Data, PHI.</li><li>Charles Diiorbach, Introduction to Computer Science using Python, Wiley.</li><li>Balaguruswamy E., Introduction to Computing and Problem Solving using Python, 2nd edition, McGraw Hill Education, 2018.</li><li>Brown, Martin C., Python: The Complete Reference, 2nd edition, McGraw Hill Education, 2018.</li></ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
| * Applicable for courses having practical components.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |

**DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS**  
**KURUKSHETRA UNIVERSITY, KURUKSHETRA**

| Scheme: 2023-24, Syllabus: 2024-25                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                           |       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------|
| Part A - Introduction                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                           |       |
| Subject                                                                                                                                                                                                                                                                                                                                                                                                    | B.Voc.(Software Development)                                                                                                                                                                                                                                                                                                                                                                                                                                             |                           |       |
| Semester                                                                                                                                                                                                                                                                                                                                                                                                   | VI                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                           |       |
| Name of the Course                                                                                                                                                                                                                                                                                                                                                                                         | Advanced Web Development                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                           |       |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                | B23-CSD-602                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                           |       |
| Course Type:<br>(CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)                                                                                                                                                                                                                                                                                                                                                  | CC-B6                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                           |       |
| Level of the course (As per Annexure-I                                                                                                                                                                                                                                                                                                                                                                     | 300-399                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                           |       |
| Pre-requisite for the course (if any)                                                                                                                                                                                                                                                                                                                                                                      | Basics of Web Development                                                                                                                                                                                                                                                                                                                                                                                                                                                |                           |       |
| Course Learning Outcomes(CLO):                                                                                                                                                                                                                                                                                                                                                                             | After completing this course, the learner will be able to:<br><div><div>1. gain proficiency in advanced web development frameworks and tools.</div><div>2. understand the principles of responsive design and progressive web apps.</div><div>3. learn best practices for database management and full-stack development.</div><div>4. know about optimization and devops.</div></div><br>5* To work on real-world projects and develop a comprehensive web application. |                           |       |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                    | Theory                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Practical                 | Total |
|                                                                                                                                                                                                                                                                                                                                                                                                            | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1                         | 4     |
| Contact Hours                                                                                                                                                                                                                                                                                                                                                                                              | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 2                         | 5     |
| Max. Marks:100(70(T)+30(P))<br>Internal Assessment Marks:30(20(T)+10(P))<br>End Term Exam Marks: 70(50(T)+20(P))                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Time: 3 Hrs.(T), 3Hrs.(P) |       |
| Part B- Contents of the Course                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                           |       |
| <u>Instructions for Paper- Setter</u><br>Examiner will set a total of nine questions. Out of which first question will be compulsory. Remaining eight questions will be set from four unit selecting two questions from each unit. Examination will be of three-hour duration. All questions will carry equal marks. First question will comprise of short answer type questions covering entire syllabus. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                           |       |



Candidate will have to attempt five questions in all, selecting one question from each unit. First question will be compulsory.

Practicum will be evaluated by an external and an internal examiner. The examination will be of three-hour duration.

| Unit                                                                                                                      | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Contact Hours                                |
|---------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
| I                                                                                                                         | <b>Advanced Front-End Development:</b> Advanced HTML5 & CSS3: Semantic HTML, CSS Grid and Flexbox, CSS Preprocessors (Sass/LESS)<br>JavaScript ES6+: Advanced JavaScript concepts (Promises, Async/Await), ES6+ features (Arrow functions, Template literals, Destructuring)                                                                                                                                                                                                                                                                                                                                                                                                                                             | 11                                           |
| II                                                                                                                        | Front-End Frameworks: Introduction to React, Angular, Component-based architecture, State management with Redux<br><b>Advanced Back-End Development:</b> Server-Side Programming: Express.js, GraphQL, Middleware, and Authentication (JWT, OAuth)                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 11                                           |
| III                                                                                                                       | Database Management: Advanced SQL concepts, NoSQL databases (Firestore), ORMs (Sequelize)<br><b>Full-Stack Development:</b> Integrating Front-End and Back-End: Building a full-stack application, Handling asynchronous operations, Real-time applications with WebSockets                                                                                                                                                                                                                                                                                                                                                                                                                                              | 11                                           |
| IV                                                                                                                        | <b>Performance Optimization:</b> Code splitting and lazy loading, Caching strategies, Optimizing images and assets<br><b>Deployment and DevOps:</b> Deployment Strategies: CI/CD pipelines, Containerization with Docker, Deployment platforms (Heroku, AWS, Netlify)<br>DevOps and Monitoring: Infrastructure as code (Terraform, Ansible), Monitoring and logging (Prometheus, Grafana)                                                                                                                                                                                                                                                                                                                                | 12                                           |
| V*                                                                                                                        | Practicum:<br>Students are advised to do laboratory/practical practice not limited to but including the following types of problems: <ul style="list-style-type: none"> <li>• <b>Front-End Projects:</b> Develop a responsive web application using React/Angular.</li> <li>• <b>Back-End Projects:</b> Build and deploy a RESTful API using Node.js and Express.js.</li> <li>• <b>Full-Stack Projects:</b> Create a full-stack application integrating front-end and back-end.</li> <li>• <b>Optimization Projects:</b> Implement performance optimization techniques on existing projects.</li> <li>• <b>Deployment Projects:</b> Set up a CI/CD pipeline and deploy a web application to a cloud platform.</li> </ul> | 30                                           |
| <b>Suggested Evaluation Methods</b>                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                              |
| <b>Internal Assessment:</b><br>➤ <b>Theory</b> <ul style="list-style-type: none"> <li>• Class Participation: 5</li> </ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>End Term Examination:</b><br>A three-hour |

|                                                                                                                                                                                                                                                                                                                                             |                                     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| <ul style="list-style-type: none"> <li>• Seminar/presentation/assignment/quiz/class test etc.: 5</li> <li>• Mid-Term Exam: 10</li> </ul> <p>➤ <b>Practicum</b></p> <ul style="list-style-type: none"> <li>• Class Participation: NA</li> <li>• Seminar/Demonstration/Viva-voce/Lab records etc.: 10</li> <li>• Mid-Term Exam: NA</li> </ul> | exam for both theory and practicum. |
| <b>Part C-Learning Resources</b>                                                                                                                                                                                                                                                                                                            |                                     |
| <p><b>Recommended Books/e-resources/LMS:</b></p> <ul style="list-style-type: none"> <li>• "JavaScript: The Good Parts" by Douglas Crockford</li> <li>• "You Don't Know JS" by Kyle Simpson</li> <li>• "Learning React" by Alex Banks and Eve Porcello</li> </ul>                                                                            |                                     |

\*Applicable for courses having practical components.

**DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS**  
**KURUKSHETRA UNIVERSITY, KURUKSHETRA**

| Scheme: 2023-24, Syllabus: 2024-25                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                          |                           |       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------|
| Part A - Introduction                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                          |                           |       |
| Subject                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | B.Voc.(Software Development)                                                                                                                                                                                                                                                                                                                                                                                                             |                           |       |
| Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | VI                                                                                                                                                                                                                                                                                                                                                                                                                                       |                           |       |
| Name of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Mobile App Development                                                                                                                                                                                                                                                                                                                                                                                                                   |                           |       |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | B23-CSD-603                                                                                                                                                                                                                                                                                                                                                                                                                              |                           |       |
| Course Type:<br>(CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | CC-C6                                                                                                                                                                                                                                                                                                                                                                                                                                    |                           |       |
| Level of the course (As per Annexure-I                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 300-399                                                                                                                                                                                                                                                                                                                                                                                                                                  |                           |       |
| Pre-requisite for the course (if any)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Basics of programming (preferably in Python/JavaScript) and object-oriented concepts                                                                                                                                                                                                                                                                                                                                                     |                           |       |
| Course Learning Outcomes(CLO):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | After completing this course, the learner will be able to:<br>1. Understand the fundamentals of Dart programming and Flutter architecture<br>2. Design responsive and interactive UI using widgets in Flutter<br>3. Manage app state and handle user input efficiently<br>4. Build functional Android applications with navigation, data, and API integration<br>5. *Deploy Flutter apps to emulator/device and understand app packaging |                           |       |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Theory                                                                                                                                                                                                                                                                                                                                                                                                                                   | Practical                 | Total |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 3                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1                         | 4     |
| Contact Hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 3                                                                                                                                                                                                                                                                                                                                                                                                                                        | 2                         | 5     |
| Max. Marks:100(70(T)+30(P))<br>Internal Assessment Marks:30(20(T)+10(P))<br>End Term Exam Marks: 70(50(T)+20(P))                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                          | Time: 3 Hrs.(T), 3Hrs.(P) |       |
| Part B- Contents of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                          |                           |       |
| <b><u>Instructions for Paper-Setter</u></b><br>The examiner will set a total of nine questions. Out of which the first question will be compulsory. The remaining eight questions will be set from four units selecting two questions from each unit. The examination will be of three-hour duration. All questions will carry equal marks. The first question will comprise short answer-type questions covering the entire syllabus.<br>The candidate will have to attempt five questions in all, selecting one question from each unit. The first question will be compulsory. |                                                                                                                                                                                                                                                                                                                                                                                                                                          |                           |       |

The practicum will be evaluated by an external and an internal examiner. The examination will be of three-hour duration.

| Unit                                                                                                                    | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Contact Hours                                |
|-------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
| I                                                                                                                       | <b>Introduction to Dart and Flutter:</b><br>Overview of mobile development platforms, Need for cross-platform development, Introduction to Flutter and Dart, Dart basics – variables, data types, control structures, functions, Introduction to OOP in Dart – classes, constructors, inheritance, Flutter architecture – widgets, build() method, hot reload, Flutter development setup – IDEs (VS Code, Android Studio), emulators                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 11                                           |
| II                                                                                                                      | <b>UI Design with Flutter Widgets:</b><br>Flutter widget tree and widget lifecycle, Stateless vs Stateful widgets, Layout widgets – Container, Column, Row, Stack, ListView, Text and Image widgets, Button and Icon widgets, Input and Form widgets – TextField, Checkbox, Switch, Form validation, Styling – themes, fonts, colors                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 11                                           |
| III                                                                                                                     | <b>Navigation and State Management:</b><br>Navigation in Flutter – routes, Navigator class, Bottom navigation bar, tabbed navigation, Passing data between screens, State management – setState, lifting state up, Introduction to Provider package for state management, Dialogs, SnackBars, and user interactions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 11                                           |
| IV                                                                                                                      | <b>Data Persistence and API Integration:</b><br>Reading/writing local data using SharedPreferences, SQLite basics using sqflite package, Fetching data from REST APIs using http package, JSON parsing and model classes, Displaying dynamic data in ListViews, Handling async operations with Future and async/await, Introduction to Firebase integration (Authentication or Realtime DB)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 12                                           |
| V*                                                                                                                      | <b>Practicum:</b><br>Students are advised to do laboratory/practical practice not limited to but including the following types of problems:<br>Problem Solving and Search Algorithms <ul style="list-style-type: none"> <li>Set up Flutter environment and run first “Hello World” app</li> <li>Implement a basic app using stateless and stateful widgets</li> <li>Build a personal profile UI with image, text, and icons</li> <li>Create a multi-page app using navigation and routes</li> <li>Handle user input and form validation</li> <li>Use state management to build a counter or to-do list app</li> <li>Store and retrieve data using SharedPreferences</li> <li>Integrate a public REST API and display data in ListView</li> <li>Build a login form with basic UI and local validation</li> <li>Mini project: Create a complete mobile application such as a note-taking app, quiz app, or weather app</li> </ul> | 30                                           |
| <b>Suggested Evaluation Methods</b>                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                              |
| <b>Internal Assessment:</b><br>➤ <b>Theory</b> <ul style="list-style-type: none"> <li>Class Participation: 5</li> </ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>End-Term Examination:</b><br>A three-hour |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                               |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• Seminar/presentation/assignment/quiz/class test etc.: 5</li> <li>• Mid-Term Exam: 10</li> </ul> <p>➤ <b>Practicum</b></p> <ul style="list-style-type: none"> <li>• Class Participation: NA</li> <li>• Seminar/Demonstration/Viva-voce/Lab records etc.: 10</li> <li>• Mid-Term Exam: NA</li> </ul>                                                                                                                                                                                                                                            | <p>exam for both theory and practicum.</p> <p><b>End Term Exam Marks: 70(50(T)+20(P))</b></p> |
| <b>Part C-Learning Resources</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                               |
| <p><b>Recommended Books/e-resources/LMS:</b></p> <ul style="list-style-type: none"> <li>• Marco L. Napoli – <i>Beginning Flutter: A Hands-On Guide to App Development</i>, Wiley</li> <li>• Alberto Miola – <i>Flutter for Beginners</i>, Packt Publishing</li> <li>• Carmine Zaccagnino – <i>Flutter Projects</i>, Packt Publishing</li> <li>• Barry Burd – <i>Flutter &amp; Dart for Dummies</i>, Wiley</li> <li>• Matt Galloway – <i>Programming Flutter</i>, O'Reilly</li> <li>• Google Flutter Documentation – <a href="https://flutter.dev/docs">flutter.dev/docs</a></li> </ul> |                                                                                               |

\*Applicable for courses having practical components.

**DEPARTMENT OF COMPUTER SCIENCE & APPLICATIONS**  
**KURUKSHETRA UNIVERSITY, KURUKSHETRA**

| Scheme: 2024-25, Syllabus: 2024-25                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                           |       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------|
| Part A - Introduction                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                           |       |
| Subject                                                                                                                                                                                                                                                                                                                                                                                                                                                           | B.Voc.(Software Development)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                           |       |
| Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                          | VI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                           |       |
| Name of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                                | Introduction to Design Thinking                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                           |       |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                       | B23-CSD-604                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                           |       |
| Course Type:<br>(CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)                                                                                                                                                                                                                                                                                                                                                                                                         | CC-M6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                           |       |
| Level of the course (As per Annexure-I                                                                                                                                                                                                                                                                                                                                                                                                                            | 300-399                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                           |       |
| Pre-requisite for the course (if any)                                                                                                                                                                                                                                                                                                                                                                                                                             | None                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                           |       |
| Course Learning Outcomes(CLO):                                                                                                                                                                                                                                                                                                                                                                                                                                    | After completing this course, the learner will be able to:<br><div>1. Understand the foundations and key stages of the design thinking process.</div> <div>2. Apply empathy and user research techniques to discover real-world problems.</div> <div>3. Ideate, prototype, and test solutions using structured tools and methods.</div> <div>4. Use design thinking for software product and interface innovation.</div> <div>5. *Practically Work collaboratively on problem-solving through a human-centered lens.</div> |                           |       |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Theory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Practical                 | Total |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1                         | 4     |
| Contact Hours                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2                         | 5     |
| Max. Marks:100(70(T)+30(P))<br>Internal Assessment Marks:30(20(T)+10(P))<br>End Term Exam Marks: 70(50(T)+20(P))                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Time: 3 Hrs.(T), 3Hrs.(P) |       |
| Part B- Contents of the Course                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                           |       |
| <p style="text-align: center;"><b><u>Instructions for Paper- Setter</u></b></p> <p>Examiner will set a total of nine questions. Out of which first question will be compulsory. Remaining eight questions will be set from four unit selecting two questions from each unit. The examination will be of three-hour duration. All questions will carry equal marks. The first question will comprise short answer-type questions covering the entire syllabus.</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                           |       |

The candidate will have to attempt five questions in all, selecting one question from each unit. The first question will be compulsory.

The practicum will be evaluated by an external and an internal examiner. The examination will be of three-hour duration.

| Unit | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Contact Hours |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| I    | <b>Foundations of Design Thinking:</b><br>Introduction to design thinking – definition, scope, and applications, Need for innovation in technology and business, Principles of human-centered design, 5-step process – Empathize, Define, Ideate, Prototype, Test, Comparison with traditional problem-solving models                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 11            |
| II   | <b>Empathize and Define:</b><br>Understanding the user – empathy maps, observation techniques, User interviews and field research, Persona development and journey maps, Problem definition using “Point of View” (POV), Creating “How Might We” (HMW) statements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 11            |
| III  | <b>Ideation Techniques:</b><br>Brainstorming rules and environment, Idea generation techniques – SCAMPER, Mind mapping, 6 Thinking Hats, Affinity mapping, Concept sketching, Idea selection using impact-feasibility matrix                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 11            |
| IV   | <b>Prototyping and Testing:</b><br>Low- and high-fidelity prototyping – tools and materials, Storyboarding and wireframing for software applications, Gathering feedback through user testing, Iterative improvement and refining ideas, Case studies of design thinking in software products (e.g., Uber, Airbnb, IDEO)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 12            |
| V*   | <b>Practicum:</b><br>Students are advised to do laboratory/practical practice not limited to but including the following types of problems: <ul style="list-style-type: none"> <li>• Create an empathy map based on a real or fictional user interview</li> <li>• Develop a persona and user journey map for a common software app</li> <li>• Define a problem statement using the POV and HMW frameworks</li> <li>• Conduct a brainstorming session using mind maps and SCAMPER</li> <li>• Sketch a wireframe of a proposed software or app solution</li> <li>• Create a low-fidelity paper prototype</li> <li>• Test the prototype with peers and collect feedback</li> <li>• Iterate on the prototype and document the changes made</li> <li>• Present the final solution using a storyboard or digital wireframe (Figma, Balsamiq)</li> <li>• Mini-project: End-to-end design thinking process for a real-world tech problem (e.g., digital attendance system, food</li> </ul> | 30            |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |               |                                                                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|----------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | ordering app) |                                                                                  |
| <b>Suggested Evaluation Methods</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |                                                                                  |
| <b>Internal Assessment:</b><br><b>➤ Theory</b> <ul style="list-style-type: none"> <li>• Class Participation: 5</li> <li>• Seminar/presentation/assignment/quiz/class test etc.: 5</li> <li>• Mid-Term Exam: 10</li> </ul> <b>➤ Practicum</b> <ul style="list-style-type: none"> <li>• Class Participation: NA</li> <li>• Seminar/Demonstration/Viva-voce/Lab records etc.: 10</li> <li>• Mid-Term Exam: NA</li> </ul>                                                                                                                                                                                                                     |               | <b>End Term Examination:</b><br>A three hour exam for both theory and practicum. |
| <b>Part C-Learning Resources</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               |                                                                                  |
| <b>Recommended Books/e-resources/LMS:</b> <ul style="list-style-type: none"> <li>• Tim Brown – <i>Change by Design</i>, Harvard Business Review Press</li> <li>• Jeanne Liedtka and Tim Ogilvie – <i>Designing for Growth: A Design Thinking Toolkit for Managers</i>, Columbia Business School Publishing</li> <li>• Vijay Kumar – <i>101 Design Methods</i>, Wiley</li> <li>• Jake Knapp – <i>Sprint: How to Solve Big Problems and Test New Ideas in Just Five Days</i>, Simon &amp; Schuster</li> <li>• Kelley &amp; Kelley – <i>Creative Confidence: Unleashing the Creative Potential Within Us All</i>, Crown Business.</li> </ul> |               |                                                                                  |

\*Applicable for courses having practical component.