

Semester-V

Part A-Introduction			
Name of the Programme	Computer Applications		
Semester	V		
Nature of Course/Course Composition	Theory		
Name of the Course	Artificial Intelligence		
Course Code	24 L5.5-CAC-501		
Course Type	CC-5		
Course Level	300-399		
Pre-requisite for the course (if any)			
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁ : Learn the basic Artificial Intelligence (AI) concept and its application areas. CLO ₂ : Acquire the knowledge of heuristic search and approaches for knowledge representations. CLO ₃ : Understand the idea of natural language processing and predicate logic CLO ₄ : Gain knowledge of learning technologies & build expert systems.		
	Theory	Practical	Total
Credits	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Duration (in Hours)	03		
Part B-Contents of the Course			
<u>Instructions for Paper- Setter:</u>			
The paper setter shall prepare 9 questions selecting two questions from each unit with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question, comprising 7 short answer type questions carrying two marks each (total 14 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt five questions: the compulsory question no. 1 and 1 question from the each of the four units.			
Unit	Topics	Contact Hours/ CLOs	
I	Introduction to Artificial Intelligence (AI), Importance of AI, AI and its Related Field, AI Techniques, Criteria for success. Problem Space and Search: Problem as a State Space Search, Production System and its Characteristics, Issues in the Design of the Search Problem.	15/CLO ₁	
II	Heuristic search techniques: Generate and test, hill climbing, best first search technique, problem reduction, constraint satisfaction. Knowledge Representation: Definition and Importance of Knowledge, Knowledge Representation, Various Approaches Used in Knowledge Representation, Issues in Knowledge Representation.	15/CLO ₂	
III	Using Predicate Logic: Representing Simple Facts in Logic, Representing Instances and is-a Relationship, Computable Function and Predicate, Natural Language Processing: Introduction, Syntactic Processing, Semantic Processing, Discourse and Pragmatic Processing.	15/CLO ₃	
IV	Learning: Introduction to Learning, Rote Learning, Learning by Taking Advice, Learning in Problem-Solving, Learning from Example- Induction, Explanation-Based Learning. Expert System: Introduction, Representing Using Domain-Specific Knowledge, Expert System Shells.	15/CLO ₄	
	Total Contact hours	60	

Evaluation Methods		
Internal Assessment:30 Marks		End Term Examination:70 Marks
• Class Participation:	5	Written Examination:70
• Seminar/presentation/assignment/quiz/ class test etc.:	10	
• Mid-Term Exam:	15	
Part C-Learning Resources		
Recommended Books/e-resources/LMS:		
• E. Richand K. Knight, Artificial Intelligence, TMH.		
• D. W.Patterson, Introduction to AI and Expert Systems, PHI.		
• Nils J Nilsson, Artificial Intelligence-A new Synthesis, Harcourt Asia Ltd.		

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes

CLOs	PLO ₁	PLO ₂	PLO ₃	PLO ₄	PLO ₅	PLO ₆	PLO ₇	PLO ₈	PLO ₉	PLO ₁₀	PLO ₁₁
CLO ₁	1	3	3	2	3	3	3	3	2	3	2
CLO ₂	3	3	3	1	3	3	3	1	2	3	3
CLO ₃	3	3	3	3	3	3	3	3	3	3	3
CLO ₄	3	3	1	3	2	2	2	2	3	3	3

Content Mapping with NEP thrust areas

Field	Content/s
Employability/Entrepreneurship	
Skill Enhancement	60
Communication Development	
Indian Knowledge System	
Environmental Awareness	
Current Issues and Social Awareness	
Women empowerment/ Gender issues	
Public policies	
Any Other	60

Part A–Introduction			
Name of the Programme	Computer Applications		
Semester	V		
Nature of Course/Course Composition	Theory + Practical		
Name of the Course	Data Analytics using Spread Sheets		
Course Code	24 L5.5-CAC-502		
Course Type	MCC-10		
Course Level	300-399		
Pre-requisite for the course(if any)			
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁ : Understand and use spread sheet tools for Data organization and analysis. CLO ₂ : Perform data cleaning, transformation, and statistical operations using spreadsheet functions. CLO ₃ : Create data visualizations to support business decisions. CLO ₄ : Apply spread sheet-based analytics to real- life problems.		
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	5	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	
Part B-Contents of the Course			
<u>Instructions for Theory Paper-Setter</u>			
The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.			
<u>Instructions for Practical Examiner</u>			
Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes. The maximum marks for the write-up and execution of the practical will be 10.			
Units	Topics		Contact Hours/ CLOs
I	Introduction to Data Analytics using Spread sheets Definition and scope of data analytics, Types of analytics– descriptive, diagnostic, predictive, prescriptive, Spreadsheet software overview –MS Excel and Google Sheets, Interface and basic operations –sorting, filtering, formatting, Cell referencing absolute, relative, mixed, Basic formulas – SUM, AVERAGE, COUNT, MIN, MAX, IF		15/CLO ₁
II	Data Cleaning and Preparation Handling missing and inconsistent data, Text functions – LEFT, RIGHT, MID, LEN, TRIM, CONCATENATE, TEXT JOIN, Logical functions – IF, AND, OR, NOT, Lookup functions – VLOOKUP, HLOOKUP, XLOOKUP, INDEX, MATCH, Date and time functions, removing duplicates, data validation, conditional formatting, Flash fill, importing data (CSV, TSV)		15/CLO ₂
III	Statistical Analysis using Spread sheets Descriptive statistics – Mean, Median, Mode, Variance, Standard Deviation, Frequency distributions, Histograms, Charts–bar, pie, line, scatter, Using Pivot Tables and Pivot Charts, Correlation and Regression Basics, Using Data Analysis Tool Pak, Applied Analytics and Dash boarding Business case studies – sales, marketing, finance, What-If analysis – Goal Seek, Data Tables, Scenario Manager, Creating dash boards – charts, slicers, pivot tables, Introduction to macros(recording only), Collaborative analytics using Google		15/CLO ₃

	Sheets, Report generation and export, Ethics in data handling.					
Practical	Students are advised to do laboratory/practical practice not limited to but including the following types of problems: • Formatting and organizing raw data in Excel • Using basic functions (SUM, AVERAGE, COUNTIF) on sales dataset • Data cleaning using text and logical functions • Using VLOOK UP and INDEX-MATCH for data retrieval • Creating Pivot Tables and Pivot Charts • Conditional formatting for outlier detection • Generating summary statistics with Data Analysis Tool Pak • Creating charts to visualize survey data • What-If analysis using Goal Seek and Scenario Manager • Designing a dashboard for monthly sales performance • Create a class called cube with the data members • Recording and executing simple macros				30/CLO ₄	
	Contact Hours				75	
Evaluation Methods						
Internal Assessment	TH-25	PR-5	End Term Examination:70	TH-50	PR-20	
Class Participation:	5	0	Lab record	NA	05	
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05	
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	50	NA	
Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10	
Part C-Learning Resources						
Recommended Books/e-resources/LMS: • Exploring Microsoft Excel for Data Analysis by R. Kishore and B. Sinha • Data Analysis Using Microsoft Excel by Michael R. Middleton • Excel 2021 Bible by Michael Alexander • Google Workspace Documentation • NPTEL/Coursera Excel Courses,						

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes

CLOs	PLO ₁	PLO ₂	PLO ₃	PLO ₄	PLO ₅	PLO ₆	PLO ₇	PLO ₈	PLO ₉	PLO ₁₀	PLO ₁₁
CLO ₁	1	3	3	2	3	3	3	3	2	3	2
CLO ₂	3	3	3	1	3	3	3	1	2	3	3
CLO ₃	3	3	3	3	3	3	3	3	3	3	3
CLO ₄	3	3	1	3	2	2	2	2	3	3	3

Content Mapping with NEP thrust areas

Field	Content/s
Employability/Entrepreneurship	
Skill Enhancement	75
Communication Development	
Indian Knowledge System	
Environmental Awareness	
Current Issues and Social Awareness	
Women empowerment/ Gender issues	
Public policies	
Any Other	75

Part A-Introduction			
Name of the Programme	Computer Applications		
Semester	V		
Nature of Course/Course Composition	Theory + Practical		
Name of the Course	Linux and Shell Programming		
Course Code	24 L5.5-CAC-503		
Course Type	DSE-2		
Course Level	300-399		
Pre-requisite for the course (if any)	Must have basic knowledge of computer		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁ : Understand Linux architecture. CLO ₂ : Use various Linux commands that are used to manipulate system operations. CLO ₃ : Acquire knowledge of Linux File System. CLO ₄ : Understand and make effective use of I/O and shell scripting language to solve problems. CLO ₅ : To implement the programs based on various shell commands and programs in Linux.		
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	5	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	
Part B-Contents of the Course			
<u>Instructions for Theory Paper-Setter</u>			
The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.			
<u>Instructions for Practical Examiner</u>			
Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes. The maximum marks for the write-up and execution of the practical will be 10.			
Units	Topics		Contact Hours/ CLOs
I	Introduction to Linux: Linux distributions, Overview of Linux operating system, Linux architecture, Features of Linux, Accessing Linux system, Starting and shutting down system, Logging in and Logging out, Comparison of Linux with other operating systems.		15/CLO ₁
II	Commands in Linux: General-purpose commands, File oriented commands, directory-oriented commands, Communication-oriented commands, process-oriented commands, etc. Regular expressions & Filters in Linux: Simple filters viz. more, wc, diff, sort, uniq, grep; Introducing regular expressions.		15/CLO ₂
III	Linux file system: Linux files, inodes and structure and file system, file system components, standard file system, file system types. Processes in Linux: Starting and Stopping Processes, Initialization Processes, Mechanism of process creation, and Job control in Linux using at, batch, cron & time. Shell Programming: vi editor, shell variables, I/O in shell, control structures, loops, sub programs, creating & executing shell scripts in Linux.		15/CLO ₃
Practical	Practicum:		30/CLO ₄

	Students are advised to do laboratory/practical practice not limited to but including the following types of problems: • Basic Linux command • Basic Shell Programming (Fibonacci Series generation, Factorial of a given number, Checking for Armstrong number) • Designing an Arithmetic calculator • Generation of Multiplication table • Base Conversion (Decimal to Binary, Binary to Decimal) • Finding the information about the Login name and File name. • Write a shell script to exchange the contents of two variables. • Write a shell script, which accepts three subject marks scored by a student and declare the result. • Write a shell script program to find area of a square, rectangle, circle and triangle.					
	Contact Hours					75
Evaluation Methods						
Internal Assessment	TH-25	PR-5	End Term Examination:70	TH-50	PR-20	
Class Participation:	5	0	Lab record	NA	05	
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05	
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	50	NA	
Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10	
Part C-Learning Resources						
Recommended Books/e-resources/LMS: • Yashwant Kanetkar, Unix & Shell programming–BPB Publications. • Richard Petersen, The Complete Reference–Linux, Mc Graw-Hill. • M. G. Venkatesh Murthy, Introduction to Unix & Shell Programming, Pearson Education. • Stephen Prata, Advanced UNIX-A Programmer’s Guide, SAMS Publication. • Sumitabha Das, Your Unix- The Ultimate Guide, Tata Mc Graw-Hill.						

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes

CLOs	PLO ₁	PLO ₂	PLO ₃	PLO ₄	PLO ₅	PLO ₆	PLO ₇	PLO ₈	PLO ₉	PLO ₁₀	PLO ₁₁
CLO ₁	1	3	3	2	3	3	3	3	2	3	2
CLO ₂	3	3	3	1	3	3	3	1	2	3	3
CLO ₃	3	3	3	3	3	3	3	3	3	3	3
CLO ₄	3	3	1	3	2	2	2	2	3	3	3

Content Mapping with NEP thrust areas

Field	Content/s
Employability/Entrepreneurship	
Skill Enhancement	75
Communication Development	
Indian Knowledge System	
Environmental Awareness	
Current Issues and Social Awareness	
Women empowerment/ Gender issues	
Public policies	
Any Other	75

Part A–Introduction			
Name of the Programme	Computer Applications		
Semester	V		
Nature of Course/Course Composition	Theory + Practical		
Name of the Course	Web Development		
Course Code	24 L5.5-CAC-504		
Course Type	DSE-2		
Course Level	300-399		
Pre-requisite for the course(if any)			
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁ : learn the basics of web development. CLO ₂ : Understand different types of web pages and web sites. CLO ₃ : Implement HTML and CSS for web page designing. CLO ₄ : Understand the design of web crawlers and search engines.		
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	5	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	
Part B - Contents of the Course			
<u>Instructions for Theory Paper-Setter</u>			
The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.			
<u>Instructions for Practical Examiner</u>			
Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes. The maximum marks for the write-up and execution of the practical will be 10.			
Units	Topics		Contact Hours/ CLOs
I	Introduction to Internet and World Wide Web (WWW); Evolution and History of World Wide Web, Web Pages and Contents, Web Clients, Web Servers, Web Browsers; Hypertext Transfer Protocol, URLs; Searching, Search Engines and Search Tools. Web Publishing: Hosting website; Internet Service Provider; Planning and designing website; Web Graphics Design, Steps for Developing website		15/CLO ₁
II	Creating a Website and Introduction to Markup Languages (HTML and DHTML), HTML Document Features & Fundamentals, HTML Elements, Creating Links; Headers; Text styles; Text Structuring; Text colour and Background; Formatting text; Page layouts, Images; Ordered and Unordered lists; Inserting Graphics; Table Creation and Layouts; Frame Creation and Layouts; Working with Forms and Menus; Working with Radio Buttons; Check Boxes; Text Boxes, HTML5.		15/CLO ₂
III	Introduction to CSS (Cascading Style Sheets): Features, Core Syntax, Types, Style Sheets and HTML, Style Rule Cascading and Inheritance, Text Properties, CSS Box Model, Normal Flow Box Layout, Positioning and other Useful Style Properties; Features of CSS3. The Nature of Java Script:		15/CLO ₃

	Evolution of Scripting Languages, Java Script- Definition, Programming for Non-Programmers, Introduction to Client–Side Programming, Enhancing HTML Documents with Java Script. Static and Dynamic web pages					
Practical	- Students are advised to do laboratory/practical practice not limited to but including the following types of problems: - Create a web page using an ordered list and an unordered list. - Design a web page to show your institute with hyperlinks. - Create your resume on an HTML page. - Create a web page and divide the web page into four frames. In one frame create three links that will display different HTML forms in the remaining three frames respectively. - Create a web page to show the college records in the form of a table. - Write an HTML code to add internal CSS on a web page. - Design a blog-style personal website. - Design a web page to display your college with hyperlinks. - Write a Java Script function to calculate the sum of two numbers. - Write a Java Script program to find the maximum number in an array. - Write a Java Script function to check if a given string is a palindrome (reads the same forwards and backward). - Write a CSS file and attach it to any 3 HTML web pages. - Using HTML, CSS create a styled check box with animation on state change - Design a web page that is like a compose page of e-mail. It should have: - Text boxes for To, CC, and BCC respectively. - Text field for the message. - Send button. - Option for selecting a file for attachment - After clicking a send button a new page should open with the display message “Message has been sent”.					30/CLO ₄
Contact Hours					75	
Evaluation Methods						
Internal Assessment	TH-25	PR-5	End Term Examination:70	TH-50	PR-20	
Class Participation:	5	0	Lab record	NA	05	
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05	
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	50	NA	
Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10	
Part C-Learning Resources						
Recommended Books/e-resources/LMS:						
- Raj Kamal, Internet and Web Technologies, Tata Mc Graw-Hill. - Ramesh Bangia, Multimedia and Web Technology, Firewall Media. - Thomas A. Powell, Web Design: The Complete Reference, Tata McGraw-Hill - Wendy Willard, HTML Beginners Guide, Tata McGraw-Hill. - Deitel and Goldberg, Internet and World Wide Web, How to Program, PHI - David Flanagan, Java Script: The Definitive Guide: The Definitive Guide. - Kogent Learning, Web Technologies: HTML, Java Script, PHP, Java, JSP, XML, AJAX – Black Book.						

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes

CLOs	PLO ₁	PLO ₂	PLO ₃	PLO ₄	PLO ₅	PLO ₆	PLO ₇	PLO ₈	PLO ₉	PLO ₁₀	PLO ₁₁
CLO ₁	1	3	3	2	3	3	3	3	2	3	2
CLO ₂	3	3	3	1	3	3	3	1	2	3	3
CLO ₃	3	3	3	3	3	3	3	3	3	3	3
CLO ₄	3	3	1	3	2	2	2	2	3	3	3

Content Mapping with NEP thrust areas

Field	Content/s
Employability/Entrepreneurship	
Skill Enhancement	75
Communication Development	
Indian Knowledge System	
Environmental Awareness	
Current Issues and Social Awareness	
Women empowerment/ Gender issues	
Public policies	
Any Other	75

Part A-Introduction			
Name of the Programme	Computer Applications		
Semester	V		
Nature of Course/Course Composition	Theory		
Name of the Course	Mobile Application Development		
Course Code	24 L5.5-CAC-505		
Course Type	DSE-3		
Course Level	300-399		
Pre-requisite for the course (if any)	Basic understanding of computer systems and programming.		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁ : Build enterprise level mobile applications with Kotlin on Android CLO ₂ : Understand both the basic and advanced concepts of Kotlin CLO ₃ : Understand why use Kotlin over Java CLO ₄ : Install and configure Android Studio		
	Theory	Practical	Total
Credits	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Duration (in Hours)	03		
Part B - Contents of the Course			
<u>Instructions for Paper- Setter:</u>			
The paper setter shall prepare 9 questions selecting two questions from each unit with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question, comprising 7 short answer type questions carrying two marks each (total 14 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt five questions: the compulsory question no. 1 and 1 question from the each of the four units.			
Units	Topics		Contact Hours/ CLOs
I	Introduction: Mobile operating system, Operating system structure, Constraints and Restrictions, Hardware configuration with mobile operating system, Features: Multitasking Scheduling, Memory Allocation, File System Interface, Keypad Interface, I/O Interface, Protection and Security, Multimedia features		15/CLO ₁
II	Introduction to Mobile development IDE's, Introduction to Worklight basics, Optimization, pages and fragments, Writing a basic program- in Worklight Studio, Client technologies, Client side debugging, Creating adapters, Invoking adapters from Worklight Client application, Common Controls, Using Java in adapters, Programming exercise with Skins, Understanding Apache Cordova.		15/CLO ₂
III	Understanding Apple iOS development, Android development, Shell Development, Creating Java ME application, Exploring the Worklight Server, Working with UI frameworks, Authentication, Push notification, SMS Notifications, Globalization.		15/CLO ₃
IV	Android: Introduction to Android, Architecture, memory management, communication protocols, application development methods, deployment. iOS: Introduction to iOS, Architecture, memory management, communication protocols, application development methods, deployment.		15/CLO ₄

	Total Contact hours	60
Evaluation Methods		
Internal Assessment:30 Marks		End Term Examination:70 Marks
• Class Participation:	5	Written Examination:70
• Seminar/presentation/assignment/quiz/ class test etc.:	10	
• Mid-Term Exam:	15	
Part C - Learning Resources		
Recommended Books/e-resources/LMS:		
• Anubhav Pradhan, Anil V Deshpande, “Mobile Apps Development” Edition: • Jeff Mc Wherter, Scott Gowell “Professional Mobile Application Development”, John Wiley & Sons,2012. • Barry Burd, “Android Application Development All in one for Dummies”, Edition I • Teach Yourself Android Application Development In 24 Hours, Edition: I, Publication: SAMS • Neal Goldstein, Tony Bove,“iPhone Application Development All-In-One For Dummies”, John Wiley & Sons. • Henry Lee, Eugene Chuvyrov, “Beginning Windows Phone App Development”, Apress,2012. • Jochen Schiller, “Mobile Communications”, Addison-Wesley,2nd edition,2004. • Stojmenovic and Cacute, “Hand book of Wireless Networks and Mobile Computing”, Wiley, 2002, ISBN0471419028.		

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes

CLOs	PLO ₁	PLO ₂	PLO ₃	PLO ₄	PLO ₅	PLO ₆	PLO ₇	PLO ₈	PLO ₉	PLO ₁₀	PLO ₁₁
CLO ₁	1	3	3	2	3	3	3	3	2	3	2
CLO ₂	3	3	3	1	3	3	3	1	2	3	3
CLO ₃	3	3	3	3	3	3	3	3	3	3	3
CLO ₄	3	3	1	3	2	2	2	2	3	3	3

Content Mapping with NEP thrust areas

Field	Content/s
Employability/Entrepreneurship	
Skill Enhancement	60
Communication Development	
Indian Knowledge System	
Environmental Awareness	
Current Issues and Social Awareness	
Women empowerment/ Gender issues	
Public policies	
Any Other	60

Part A-Introduction			
Name of the Programme	Computer Applications		
Semester	V		
Nature of Course/Course Composition	Theory		
Name of the Course	Multimedia Technology		
Course Code	24 L5.5-CAC-506		
Course Type	DSE-3		
Course Level	300-399		
Pre-requisite for the course (if any)	Basic understanding of computer systems and programming.		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO1: Master tools for 2D/3D animation, image editing, and audio-video processing. CLO2: Design and create interactive multimedia applications, games, and web content. CLO3: Analyze encoding algorithms, data compression (JPEG, MPEG), and file formats. CLO4: Evaluate digital media effectiveness and apply design principles for engaging user experiences.		
	Theory	Practical	Total
Credits	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Duration (in Hours)	03		
Part B – Contents of the Course			
Instructions for Paper- Setter:			
The paper setter shall prepare 9 questions selecting two questions from each unit with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question, comprising 7 short answer type questions carrying two marks each (total 14 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt five questions: the compulsory question no. 1 and 1 question from the each of the four units.			
Units	Topics		Contact Hours/ CLOs
I	Introduction Multimedia: meaning, Various facts of multimedia: audio, text, graphics, animation, video Classification of multimedia technology Multimedia: hardware/software essentials, different categories of multimedia software.		15/CLO ₁
II	Working with Audio, Text Multimedia Audio: Introduction, digital audio and sound card fundamentals, sound card functionalities, audio jacks, connectors, digital audio playback, audio editing. Multimedia Text: Introduction, designing text for multimedia, hypermedia, hypertext.		15/CLO ₂
III	Working with Graphics and Video Multimedia Graphics: Introduction, basic concepts of colour displays, color depth, Resolution, Digital Imaging, Camera specification, Graphics editing concepts. Multimedia Video: Introduction, video in multimedia projects, digital video fundamental, full motion and full screen videos, digital video files sizes, digital video production techniques – video production in multimedia, shooting the		15/CLO ₃

	sequences, video capture techniques, video capture boards, video capture software, editing video, embedding sound clips.	
IV	Multimedia Animation, Project and Authoring Multimedia Animation: introduction, classifications, two-dimensional animation and three-dimensional animation technology, animation development process, names of animation software tools for 2D and 3D Multimedia project design concepts–introduction, concept and design, various facets, media content design and development, interface design and development process. Multimedia authoring: introduction, authoring methodologies, characteristics of authoring tools, Commercial authoring tools.	15/CLO ₄
	Total Contact hours	60
Evaluation Methods		
Internal Assessment:30 Marks		End Term Examination:70 Marks
• Class Participation:	5	Written Examination:70
• Seminar/presentation/assignment/quiz/ class test etc.:	10	
• Mid-Term Exam:	15	
Part C – Learning Resources		
Recommended Books/e-resources/LMS:		
• Multimedia Magic. By S. Gokul, BPB Publications, 1998 and (Revised and updated Second Edition) 2005. • Introduction to Multimedia: By Ana Weston Solomon, Tata McGraw-Hill Publishing Company Limited, 2005		

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes

CLOs	PLO ₁	PLO ₂	PLO ₃	PLO ₄	PLO ₅	PLO ₆	PLO ₇	PLO ₈	PLO ₉	PLO ₁₀	PLO ₁₁
CLO ₁	1	3	3	2	3	3	3	3	2	3	2
CLO ₂	3	3	3	1	3	3	3	1	2	3	3
CLO ₃	3	3	3	3	3	3	3	3	3	3	3
CLO ₄	3	3	1	3	2	2	2	2	3	3	3

Content Mapping with NEP thrust areas

Field	Content/s
Employability/Entrepreneurship	
Skill Enhancement	60
Communication Development	
Indian Knowledge System	
Environmental Awareness	
Current Issues and Social Awareness	
Women empowerment/ Gender issues	
Public policies	
Any Other	60

Semester-VI

Part A-Introduction			
Name of the Programme	Computer Applications		
Semester	VI		
Nature of Course/Course Composition	Theory + Practical		
Name of the Course	Programming in R		
Course Code	24 L5.5-CAC-601		
Course Type	CC-6/MCC-11		
Course Level	300-399		
Pre-requisite for the course (if any)	Basic knowledge of statistics, programming fundamentals, and data structures.		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁ : Understand the fundamentals of R programming language. CLO ₂ : Write and debug R programs for data analysis. CLO ₃ : Work with data frames, lists, and control structures in R. CLO ₄ : Apply statistical functions and data visualization techniques.		
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	5	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	
Part B – Contents of the Course			
Instructions for Theory Paper-Setter			
The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.			
Instructions for Practical Examiner			
Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes. The maximum marks for the write-up and execution of the practical will be 10.			
Units	Topics		Contact Hours/ CLOs
I	Introduction to R and R Studio: Installing R and R Studio, R as a calculator, variables and data types, R scripts and console, R packages and libraries, Basic I/O operations, Basic functions in R. Data Structures and Control Flow: Vectors, matrices, arrays, lists, data frames, factors, Type coercion and indexing, Conditional statements: if, else, switch, Looping: for, while, repeat, apply family of functions (apply, lapply, sapply)		15/CLO ₁
II	Data Manipulation and Visualization: Reading and writing data (CSV, Excel, TXT), Data cleaning and preprocessing using dplyr, Filtering, selecting, mutating, summarizing data, Data visualization using ggplot2, Histograms, bar charts, scatter plots, box plots, Handling missing data.		15/CLO ₂
III	Statistical Analysis and R for Data Science: Descriptive statistics: mean, median, mode, variance, Standard deviation and correlation, Hypothesis testing: t-test, chi-square, ANOVA, Introduction to linear regression, Introduction to R for machine learning and data science (overview), Project: exploratory data analysis on real-world dataset.		15/CLO ₃

Practical	Students are advised to do laboratory/practical practice not limited to but including the following types of problems: • Install and setup R and RStudio • Write R scripts using basic data types and operators • Create and manipulate vectors, matrices, and data frames • Implement control structures and functions in R • Load and clean data using read.csv () and dplyr functions • Create visualizations using ggplot2 (bar, line, scatter, histogram) • Perform basic statistical analysis using in-built R functions • Conduct hypothesis testing using t-test and chi-square test • Build a simple linear regression model • Mini-project: Exploratory data analysis on a real dataset (e.g., COVID-19, sales, population)					30/CLO ₄
	Contact Hours					75
Evaluation Methods						
Internal Assessment		TH-25	PR-5	End Term Examination:70	TH-50	PR-20
Class Participation:		5	0	Lab record	NA	05
Seminar/presentation/assignment/quiz/class test etc.:		5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva-voce/Lab records etc.:		NA	5	Written Examination	50	NA
Mid-Term Exam:		15	NA	Write-up and execution of the practical	NA	10
Part C – Learning Resources						
Recommended Books/e-resources/LMS: • The Art of R Programming by Norman Matloff • R for Data Science by Hadley Wickham and Garrett Grolemund • Hands – On Programming with R by Garrett Grolemund • Beginning R: The Statistical Programming Language by Mark Gardener • Practical Data Science with R by Nina Zumel and John Mount						

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes

CLOs	PLO ₁	PLO ₂	PLO ₃	PLO ₄	PLO ₅	PLO ₆	PLO ₇	PLO ₈	PLO ₉	PLO ₁₀	PLO ₁₁
CLO ₁	1	3	3	2	3	3	3	3	2	3	2
CLO ₂	3	3	3	1	3	3	3	1	2	3	3
CLO ₃	3	3	3	3	3	3	3	3	3	3	3
CLO ₄	3	3	1	3	2	2	2	2	3	3	3

Content Mapping with NEP thrust areas

Field	Content/s
Employability/Entrepreneurship	
Skill Enhancement	75
Communication Development	
Indian Knowledge System	
Environmental Awareness	
Current Issues and Social Awareness	
Women empowerment/ Gender issues	
Public policies	
Any Other	75

Part A–Introduction			
Name of the Programme	Computer Applications		
Semester	VI		
Nature of Course/Course Composition	Theory + Practical		
Name of the Course	Advanced Web Development Techniques		
Course Code	24 L5.5-CAC-602		
Course Type	MCC-12		
Course Level	300-399		
Pre-requisite for the course (if any)			
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁ : Gain proficiency in advanced web development frame works and tools. CLO ₂ : Understand the principles of responsive design and progressive web apps. CLO ₃ : Learn best practices for data base management and full-stack development. CLO ₄ : Know about optimization and develops.		
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	5	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	
Part B - Contents of the Course			
<u>Instructions for Theory Paper-Setter</u> The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.			
<u>Instructions for Practical Examiner</u> Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes. The maximum marks for the write-up and execution of the practical will be 10.			
Units	Topics		Contact Hours/ CLOs
I	Advanced Front-End Development: Advanced HTML5 & CSS3: Semantic HTML, CSS Grid and Flexbox, CSS Preprocessors (Sass/LESS) JavaScript ES6+: Advanced JavaScript concepts (Promises, Async/Await), ES6+ features (Arrow functions, Template literals, Destructuring), Front-End Frame works: Introduction to React, Angular, Component- based architecture, State management with Redux		15/CLO ₁
II	Advanced Back-End Development: Server-Side Programming: Express.js, GraphQL, Middleware, and Authentication (JWT, OAuth). Database Management: Advanced SQL concepts, NoSQL databases (Firestore), ORMs (Sequelize) Full-Stack Development: Integrating Front-End and Back-End: Building a full-stack application, Handling asynchronous operations, Real-time applications with WebSockets		15/CLO ₂
III	Performance Optimization: Code splitting and lazy loading, Caching strategies, Optimizing images and assets Deployment and DevOps: Deployment Strategies: CI/CD pipelines, Containerization with Docker, Deployment platforms (Heroku, AWS, Netlify) DevOps and Monitoring: Infrastructure as code (Terraform, Ansible), Monitoring and		15/CLO ₃

	logging (Prometheus, Grafana)				
Practical	Students are advised to do laboratory/practical practice not limited to but including the following types of problems: ● Front-End Projects: Develop a responsive web application using React/Angular. ● Back-End Projects: Build and deploy a RESTful API using Node.js and Express.js. ● Full-Stack Projects: Create a full-stack application integrating front-end and back-end. ● Optimization Projects: Implement performance optimization techniques on existing projects. ● Deployment Projects: Set up a CI/CD pipeline and deploy a web application to a cloud platform.	30/CLO ₄			
	Contact Hours	75			
Evaluation Methods					
Internal Assessment	TH-25	PR-5	End Term Examination:70	TH-50	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	50	NA
Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10
Part C - Learning Resources					
Recommended Books/e-resources/LMS: ● "Java Script: The Good Parts " by Douglas Crockford ● "You Don't Know JS" by Kyle Simpson ● "Learning React" by Alex Banks and Eve Porcello					

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes

CLOs	PLO ₁	PLO ₂	PLO ₃	PLO ₄	PLO ₅	PLO ₆	PLO ₇	PLO ₈	PLO ₉	PLO ₁₀	PLO ₁₁
CLO ₁	1	3	3	2	3	3	3	3	2	3	2
CLO ₂	3	3	3	1	3	3	3	1	2	3	3
CLO ₃	3	3	3	3	3	3	3	3	3	3	3
CLO ₄	3	3	1	3	2	2	2	2	3	3	3

Content Mapping with NEP thrust areas

Field	Content/s
Employability/Entrepreneurship	
Skill Enhancement	75
Communication Development	
Indian Knowledge System	
Environmental Awareness	
Current Issues and Social Awareness	
Women empowerment/ Gender issues	
Public policies	
Any Other	75

Part A-Introduction			
Name of the Programme	Computer Applications		
Semester	VI		
Nature of Course/Course Composition	Theory		
Name of the Course	Software Testing		
Course Code	24 L5.5-CAC-603		
Course Type	DSE-4		
Course Level	300-399		
Pre-requisite for the course(if any)			
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁ : To understand the basic terminologies and types of testing. CLO ₂ : Understand different testing methods. CLO ₃ : Understand the testing process. CLO ₄ : Manage the tests, plan testing process and create reports.		
	Theory	Practical	Total
Credits	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Duration (in Hours)	03		
Part B – Contents of the Course			
Instructions for Paper- Setter: The paper setter shall prepare 9 questions selecting two questions from each unit with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question, comprising 7 short answer type questions carrying two marks each (total 14 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt five questions: the compulsory question no. 1 and 1 question from the each of the four units.			
Unit	Topics		Contact Hours/ CLOs
I	Introduction: Definition of Software Testing and its Role, Terms: - Failure, Error, Fault, Defect, Bug, Goals of Testing, Principles of Testing, Software Testing Life Cycle, Verification and Validation: - V-testing Life cycle		15/CLO ₁
II	Types of Testing: Black Box Testing: Overview: What is & When? Techniques: Boundary Value Analysis, Equivalence class testing, Decision Table White Box Testing: What is white box Testing, Need of white box Testing, Classification, Structural: Coverage, Path testing		15/CLO ₂
III	Levels of Testing Unit Testing: Overview, Integration Testing: Overview, Techniques: Graph based & Path based, Functional Testing, System Testing: Overview, Categories: Reliability Security Performance Recovery, Acceptance Testing: Overview, Types of Acceptance Testing		15/CLO ₃
IV	Test Planning: Preparing a Test plan, Scope management, Decide Test Approach, Setting Up Criteria, for testing, Identifying responsibilities, Staffing, training needs, Resource requirements, Test deliverables, Testing Tasks		15/CLO ₄
	Total Contact hours		60
Evaluation Methods			
Internal Assessment:30 Marks		End Term Examination:70 Marks	
• Class Participation:	5	Written Examination:70	
• Seminar/presentation/assignment/quiz/ class test etc.:	10		

• Mid-Term Exam:	15
Part C – Learning Resources	
Recommended Books/e-resources/LMS: • Software Testing: Principles and Practice by Srinivasan Desikan, Gopalaswamy Ramesh, Pearson Publication • Software Testing: Principles and Practice by Naresh Chauhan, Oxford • Software Testing: Easy Learning Approach by Shubha Agarwal Kundlas	

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes

CLOs	PLO ₁	PLO ₂	PLO ₃	PLO ₄	PLO ₅	PLO ₆	PLO ₇	PLO ₈	PLO ₉	PLO ₁₀	PLO ₁₁
CLO ₁	1	3	3	2	3	3	3	3	2	3	2
CLO ₂	3	3	3	1	3	3	3	1	2	3	3
CLO ₃	3	3	3	3	3	3	3	3	3	3	3
CLO ₄	3	3	1	3	2	2	2	2	3	3	3

Content Mapping with NEP thrust areas

Field	Content/s
Employability/Entrepreneurship	
Skill Enhancement	60
Communication Development	
Indian Knowledge System	
Environmental Awareness	
Current Issues and Social Awareness	
Women empowerment/ Gender issues	
Public policies	
Any Other	60

Part A - Introduction			
Name of the Programme	Computer Applications		
Semester	VI		
Nature of Course/Course Composition	Theory		
Name of the Course	Security Threats and Trends		
Course Code	24 L5.5-CAC-604		
Course Type	DSE-4		
Course Level	300-399		
Pre-requisite for the course (if any)			
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁ : Understand various security threats and attack methods. CLO ₂ : Analyze risks and vulnerabilities in systems. CLO ₃ : Apply security controls and protection mechanisms. CLO ₄ : Evaluate emerging trends and future challenges in cybersecurity.		
	Theory	Practical	Total
Credits	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Duration (in Hours)	03		
Part B - Contents of the Course			
Instructions for Paper- Setter: The paper setter shall prepare 9 questions selecting two questions from each unit with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question, comprising 7 short answer type questions carrying two marks each (total 14 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt five questions: the compulsory question no. 1 and 1 question from the each of the four units.			
Unit	Topics		Contact Hours/ CLOs
I	Fundamentals of Security and Threat Landscape: Introduction to Cyber security and Information Security, Concepts: Threat, Vulnerability, Risk, and Attack, Security Goals: Confidentiality, Integrity, Availability (CIA Triad), Types of Cyber Threats and Cyber crimes, Classification of Assets and Data Protection Requirements, Overview of Cyber security Frame works and Standards		15/CLO ₁
II	Types of Security Threats and Attack Techniques Malware: Virus, Worm, Trojan Horse, Ransomware, Spyware Network Attacks: DoS/DDoS, Man-in-the-Middle (MITM), Sniffing, Spoofing Application Attacks: SQL Injection, Cross-Site Scripting (XSS) Social Engineering: Phishing, Spear Phishing, Identity Theft Password Attacks: Brute Force, Dictionary Attacks Insider Threats and Advanced Persistent Threats (APT)		15/CLO ₂
III	Security Mechanisms and Risk Management: Security Controls: Preventive, Detective, Corrective Cryptography Basics: Encryption, Decryption, Hashing, Digital Signatures Network Security Tools: Firewalls, IDS/IPS, Antivirus Identity and Access Management (IAM), Multi-Factor Authentication Risk Assessment and Risk Management Process Security Policies, Standards, and Compliance		15/CLO ₃
IV	Emerging Trends and Incident Management: Incident Response Lifecycle and Disaster Recovery Digital Forensics Basics Cloud Security and Virtualization Risks Internet of Things (IoT) Security Challenges Artificial Intelligence in Cybersecurity Zero Trust Security Model Privacy Issues, Cyber Laws, and Ethical Concerns Future Trends in Cybersecurity		15/CLO ₄
	Total Contact hours		60
Evaluation Methods			

Internal Assessment:30 Marks		End Term Examination:70 Marks
• Class Participation:	5	Written Examination:70
• Seminar/presentation/assignment/quiz/ class test etc.:	10	
• Mid-Term Exam:	15	
Part C – Learning Resources		
Recommended Books/e-resources/LMS:		
• Cybersecurity Essentials by Charles J. Brooks, Christopher Grow, Philip Craig, Donald Short (Cisco Press) • Cyber Security by: Nina Godbole and Sunit Belapure, Publisher: Wiley India • Network Security Essentials by William Stallings Publisher: Pearson		

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes

CLOs	PLO ₁	PLO ₂	PLO ₃	PLO ₄	PLO ₅	PLO ₆	PLO ₇	PLO ₈	PLO ₉	PLO ₁₀	PLO ₁₁
CLO ₁	1	3	3	2	3	3	3	3	2	3	2
CLO ₂	3	3	3	1	3	3	3	1	2	3	3
CLO ₃	3	3	3	3	3	3	3	3	3	3	3
CLO ₄	3	3	1	3	2	2	2	2	3	3	3

Content Mapping with NEP thrust areas

Field	Content/s
Employability/Entrepreneurship	
Skill Enhancement	60
Communication Development	
Indian Knowledge System	
Environmental Awareness	
Current Issues and Social Awareness	
Women empowerment/ Gender issues	
Public policies	
Any Other	60

Part A-Introduction			
Name of the Programme	Computer Applications		
Semester	VI		
Nature of Course/Course Composition	Theory		
Name of the Course	Ethical Hacking		
Course Code	24 L5.5-CAC-605		
Course Type	DSE-5		
Course Level	300-399		
Pre-requisite for the course (if any)			
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁ : Understand ethical hacking concepts and methodologies. CLO ₂ : Identify and analyze system and network vulnerabilities. CLO ₃ : Perform basic penetration testing and security assessment. CLO ₄ : Apply security measures and understand modern hacking trends.		
	Theory	Practical	Total
Credits	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Duration (in Hours)	03		
Part B – Contents of the Course			
<u>Instructions for Paper- Setter:</u>			
The paper setter shall prepare 9 questions selecting two questions from each unit with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question, comprising 7 short answer type questions carrying two marks each (total 14 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt five questions: the compulsory question no. 1 and 1 question from the each of the four units.			
Unit	Topics		Contact Hours/ CLOs
I	Introduction to Ethical Hacking: Introduction to Ethical Hacking and Information Security Types of Hackers: White Hat, Black Hat, Grey Hat Concepts: Threat, Vulnerability, Risk, and Exploit Phases of Ethical Hacking (Reconnaissance, Scanning, Gaining Access, Maintaining Access, Covering Tracks) Foot printing and Reconnaissance Techniques Legal and Ethical Issues in Hacking		15/CLO ₁
II	Scanning, Enumeration, and System Hacking: Scanning Techniques: Port Scanning, Network Scanning Enumeration: DNS, SNMP, User and System Enumeration Vulnerability Assessment and Scanning Tools System Hacking Concepts Password Cracking Techniques (Brute Force, Dictionary, Rainbow Tables) Privilege Escalation and Maintaining Access		15/CLO ₂
III	Network and Web Application Attacks: Network Attacks: DoS/DDoS, Session Hijacking, Sniffing Man-in-the-Middle (MITM) Attacks Wireless Network Attacks Web Application Attacks: SQL Injection, Cross-Site Scripting (XSS), CSRF Malware Threats: Viruses, Worms, Trojans Social Engineering Attacks: Phishing, Spear Phishing		15/CLO ₃

IV	Security Measures, Tools, and Emerging Trends: Penetration Testing Methodology Security Tools: Firewalls, IDS/IPS, Antivirus, Vulnerability Scanners Cryptography Basics in Ethical Hacking Incident Response and Reporting Legal Frameworks and Cyber Laws Emerging Trends in Ethical Hacking (AI in Security, Zero Trust, Automation)	15/CLO ₄
	Total Contact hours	60
Evaluation Methods		
Internal Assessment:30 Marks		End Term Examination:70 Marks
• Class Participation:	5	Written Examination:70
• Seminar/presentation/assignment/quiz/ class test etc.:	10	
• Mid-Term Exam:	15	
Part C – Learning Resources		
Recommended Books/e-resources/LMS:		
• Cyber Security and Cyber Laws by Nina Godbole, Sunit Belapure Publisher: Wiley India • Ethical Hacking and Cyber Security by R. K. Jain • Introduction to Cyber Security by Anand Shinde		

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes

CLOs	PLO ₁	PLO ₂	PLO ₃	PLO ₄	PLO ₅	PLO ₆	PLO ₇	PLO ₈	PLO ₉	PLO ₁₀	PLO ₁₁
CLO ₁	1	3	3	2	3	3	3	3	2	3	2
CLO ₂	3	3	3	1	3	3	3	1	2	3	3
CLO ₃	3	3	3	3	3	3	3	3	3	3	3
CLO ₄	3	3	1	3	2	2	2	2	3	3	3

Content Mapping with NEP thrust areas

Field	Content/s
Employability/Entrepreneurship	
Skill Enhancement	60
Communication Development	
Indian Knowledge System	
Environmental Awareness	
Current Issues and Social Awareness	
Women empowerment/ Gender issues	
Public policies	
Any Other	60

Part A-Introduction			
Name of the Programme	Computer Applications		
Semester	VI		
Nature of Course/Course Composition	Theory		
Name of the Course	Cyber Forensics and Investigations		
Course Code	24 L5.5-CAC-605		
Course Type	DSE-5		
Course Level	300-399		
Pre-requisite for the course(if any)			
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁ : Understand cyber forensic principles and investigation processes. CLO ₂ : Collect, preserve, and analyze digital evidence. CLO ₃ : Perform basic network and system forensic analysis. CLO ₄ : Apply forensic tools and techniques in real-world scenarios.		
	Theory	Practical	Total
Credits	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Duration (in Hours)	03		
Part B – Contents of the Course			
<u>Instructions for Paper- Setter:</u>			
The paper setter shall prepare 9 questions selecting two questions from each unit with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question, comprising 7 short answer type questions carrying two marks each (total 14 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt five questions: the compulsory question no. 1 and 1 question from the each of the four units.			
Unit	Topics		Contact Hours/ CLOs
I	Fundamentals of Cyber Forensics: Introduction to Cyber Forensics and Digital Investigation Need and Scope of Digital Forensics Types of Cyber Crimes and Digital Evidence Characteristics and Types of Digital Evidence Forensic Readiness and Investigation Process Legal and Ethical Issues in Digital Forensics Overview of Cyber Laws and IT Act		15/CLO ₁
II	Computer Forensics and Evidence Acquisition: Computer Forensics Fundamentals Forensic Investigation Process and Methodology Evidence Collection and Preservation Techniques Chain of Custody Disk Imaging and Cloning File Systems (FAT, NTFS, EXT) and Data Recovery Forensic Tools and Software		15/CLO ₂
III	Network and Web Forensics: Network Forensics Concepts and Techniques Monitoring and Analysis of Network Traffic Log Analysis and Intrusion Detection Email Forensics and Web Forensics Investigation of Web Attacks (Phishing, SQL Injection, etc.) Wireless Network Forensics		15/CLO ₃
IV	Advanced Forensics and Incident Response: Mobile and Cloud Forensics Malware Forensics and Analysis Incident Response and Handling Digital Evidence Reporting and Documentation Forensic Tools (EnCase, FTK, Wireshark, Autopsy) Challenges in Cyber Forensics Emerging Trends in Digital Forensics		15/CLO ₄

	Total Contact hours	60
Evaluation Methods		
Internal Assessment:30 Marks		End Term Examination:70 Marks
• Class Participation:	5	Written Examination:70
• Seminar/presentation/assignment/quiz/ class test etc.:	10	
• Mid-Term Exam:	15	
Part C - Learning Resources		
Recommended Books/e-resources/LMS:		
• Cyber Security and Digital Forensics by Mangesh M. Ghonge et al., Publisher: Wiley-Scrivener • Cyber Forensics by S. Murugan, Dejeey, Publisher: Oxford University Press India • Handbook of Digital Forensics and Cyber Crime by Meenal Dhal et al., Publisher: Indian academic publisher • A Textbook of Cyber Forensic Analytics by Gaytri Gupta, Publisher: S. K. Kataria and Sons		

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes

CLOs	PLO ₁	PLO ₂	PLO ₃	PLO ₄	PLO ₅	PLO ₆	PLO ₇	PLO ₈	PLO ₉	PLO ₁₀	PLO ₁₁
CLO ₁	1	3	3	2	3	3	3	3	2	3	2
CLO ₂	3	3	3	1	3	3	3	1	2	3	3
CLO ₃	3	3	3	3	3	3	3	3	3	3	3
CLO ₄	3	3	1	3	2	2	2	2	3	3	3

Content Mapping with NEP thrust areas

Field	Content/s
Employability/Entrepreneurship	
Skill Enhancement	60
Communication Development	
Indian Knowledge System	
Environmental Awareness	
Current Issues and Social Awareness	
Women empowerment/ Gender issues	
Public policies	
Any Other	60