DIBRUGARH UNIVERSITY

Syllabus for FYUGP in Computer Science

(For Semesters I - VIII)

Recommended in the meeting of the BoS held on

22.11.2022, 09.02.2023 and 26.04.2024

With effect from the Session 2023-24

COURSE PREAMBLE

The Bachelor of Computer Science program is designed to provide students with a comprehensive understanding of computer science and its various subfields. The program aims to equip students with the necessary skills to design, develop and maintain computer systems and software applications, and to prepare them for careers in the rapidly evolving field of computer science. The program focuses on developing problem-solving skills using computer programs, database management systems, computer networks, algorithms and data structures, cloud computing, artificial intelligence, and related areas. The program also emphasizes the development of communication, analytical, and critical thinking skills.

INTRODUCTION:

The Bachelor of Computer Science program is a four-year undergraduate program designed to provide students with a strong foundation in computer science. The program is structured to ensure that students develop a comprehensive understanding of the principles and practices of computer science and its various subfields. The program comprises of eight semesters, and students are allowed different exit points with the following certification/diploma/degree:

i. Students on exit after one year of the course shall be awarded Undergraduate Certificate (in Computer Science) after securing the requisite 40 Credits in Semesters I and II.

ii. Students on exit after second years of the course shall be awarded Undergraduate Diploma (in the Computer Science) after securing the requisite 80 Credits on completion of Semester IV.

iii. Students on exit after three years of the course shall be awarded Bachelor of (Computer Science) Honours (3years) after securing the requisite 120 Credits on completion of Semester VI.

iv. Students on exit after four years of the course shall be awarded Bachelor of (Computer Science) (Honours with Research) (4 years) after securing the requisite 160 Credits on completion of Semester VIII**.**

AIM

The aim of the Bachelor of Computer Science program is to provide students with a comprehensive understanding of computer science and its various subfields. The program aims to equip students with the necessary skills to design, develop and maintain computer systems and software applications, and to prepare them for careers in the rapidly evolving field of computer science. The program also aims to develop communication, analytical, and critical thinking skills

GRADUATE ATTRIBUTES

Upon completion of the program, graduates will possess the following attributes:

- An in-depth understanding of computer science and its various subfields.
- The ability to design, develop, and maintain computer systems and software applications.
- Strong problem-solving and analytical skills.
- Effective communication and teamwork skills.
- The ability to think critically and creatively.
- An understanding of ethical and professional issues related to computer science

PROGRAMME LEARNING OUTCOMES

Upon completion of the program, graduates will be able to:

- Design, develop, and maintain computer systems and software applications using various programming languages and tools.
- Develop and manage database management systems.
- Develop and implement computer networks.
- Analyze algorithms and data structures.
- Develop and implement cloud computing solutions.
- Develop and implement artificial intelligence solutions.
- Apply mathematical and computational thinking and analysis to solve computer scienceproblems.
- Understand and analyze ethical and professional issues related to computer science.
- Communicate effectively with team members and stakeholders.
- Continuously update their knowledge and skills in the rapidly evolving field of computer science.

TEACHING-LEARNING PROCESS

The Bachelor of Computer Science program will be taught through a combination of lectures, tutorials, practical sessions, and projects. The program will use a blended learning approach, which combines online and offline learning, to provide students with flexibility and convenience. The program will also include guest lectures by industry experts to provide students with insights into real-world scenarios.

ASSESSMENT PROCESS

The assessment process for the Bachelor of Computer Science program will include a combination of continuous assessments and end-of-semester examinations. Continuous assessments will include assignments, quizzes, practical sessions, and projects, and will contribute towards the final grade for the course. End-of-semester examinations will be conducted at the end of each semester and willtest students' understanding of the course material covered during the semester. The final grade for each course will be based on the continuous assessments and end-of-semester examination.

PROGRAMME STRUCTURE FYUGP IN COMPUTER SCIENCE

Year	Semester	Course	Title of the Course	Total Credit
Year 01	1st Semester	C – 1	Problem Solving using C	4
		Minor 1	Cyber Security	4
		GEC – 1	Office Automation Tools	3
		AEC-1		4
		VAC-1		2
		SEC 1	HTML and CMS Tools	3
	Total Credit			**20**
	2nd Semester	C – 2	Database Management Systems	4
		Minor 2	Foundation of Computer Sc	4
		GEC 2	Basic Hardware Maintenance	3
		AEC 2		4
		VAC-2		2
		SEC 2	Multimedia Applications and Tools	3
Total credit				**20**
Year 02	3rd Semester	C – 3	Digital Design	4
		C – 4	Data structure using C	4
		Minor 3	Data Structure & Programming Paradigms	4
		GEC – 3	Basics of Photoshop	3
		VAC 3	Option 1: Digital Fluency **OR** Option 2: Digital and Technological Solutions	2
		SEC – 3	Basics of Pagemaker	3
	Total credit			**20**
	4th Semester	C-5	Numerical Analysis	4
		C-6	Operating System	4
		C-7	Object Oriented Programming using C++	4
		C-8	Computer Architecture	4
		Minor 4	Operating Systems and Network Management	4
Total credit				**20**

Year 03	5th Semester	C-9	Mathematical Foundation for Computer Science	4
		C-10	Design and Analysis of Algorithms	4
		C-11	Formal Language and Automata	4
		Minor 5	Digital Systems and Computer Architecture	4
		Internship/Community Engagement/Project		4
	Total Credit			20
	6th Semester	C-12	Software Engineering	4
		C-13	Statistical Foundation of Computer Science	4
		C-14	Compiler Design	4
		C-15	Data Communication and Computer Networks	4
		Minor-6	Web Application Development with Database	4
		Total Credit		20
Year 04	7th Semester	C-16	Computer Graphics	4
		C-17	Machine Learning	4
		C-18	Web Technology/ Wireless Communication Networks/ Internet of Things	4
		Minor 7	Programming in Python/R Programming /MATLAB Programming	4
		Research Ethics and Methodology		4
	Total Credit			20
	8th Semester	C-19	Information and Network Security/ Embedded System/ Digital Image processing	4
		C-20	Natural Language Processing/ Speech Processing/ Mobile Computing	4
		Minor-8	Introduction to Artificial Intelligence/ Machine Learning using Python/ Wireless Communication Networks	4
		Dissertation/ (DSE01: Big Data Analytics, DSE02:Distributed Computing)		8/(4+4)
Total Credit				20

Program Educational Objectives (PEOs)

After completion of this program, the graduates will be able to

PEO1: Compete on a global platform to pursue their professional career in Computer Science.

PEO2: Pursue higher education and/or engage in continuous up gradation of their professional skills.

PEO3: Communicate effectively and will demonstrate professional behavior while working in diverse team.

PEO4: Demonstrate concern for society and environment.

Program Specific Outcomes (PSOs)

After the successful completion of B.Sc. Computer Science program, the learners are expected to

- **PSO1:** Impart the fundamental principles and methods of Computer Science to a wide range of applications.
- **PSO2:** Develop and deploy applications of varying complexity using the acquired knowledge in various programming languages, data structures and algorithms, database and networking skills.
- **PSO3:** To investigate, analyze complex problems by the application of suitable mathematical and research tools, to design Information Technology products and solutions
- **PSO4:** To identify and utilize the state-of-the-art tools and techniques in the design and development of software products and solutions.
- **PSO5:** Ability to identify, interpret, analyze and design solutions using appropriate algorithms of varying complexities in the field of information and communication technology.

Program Outcomes (POs)

At the end of the program, the learners will be able to:

PO1: Formulate, model, design solutions, procedure and use software tools to solve real world problems.

PO 2: Design and develop computer programs/computer -based systems in the areas such as networking, web design, security, cloud computing, IoT, data science and other emerging technologies.

PO 3: Familiarize with the modern-day trends in industry and research based settings and thereby innovate novel solutions to existing problems.

PO 4: Apply concepts, principles, and theories relating to computer science to new situations.

PO 5: Use current techniques, skills, and tools necessary for computing practice.

PO 6: Apply standard Software Engineering practices and strategies in real-time software project development.

PO 7: Pursue higher studies of specialization and take up technical employment.

PO 8: Work independently or collaboratively as an effective team member on a substantial software project.

PO 9: Communicate and present their work effectively and coherently.

PO 10: Display ethical code of conduct in usage of Internet and Cyber systems.

PO 11: Engage in independent and life-long learning in the background of rapid changing IT industry

Title of the Course	**:**	**PROBLEM SOLVING USING C**
Course Code	**:**	**C - 1**
Nature of the Course	**:**	**Major**
Total Credits	**:**	**04**
Distribution of Marks	**:**	**End-Sem:45 TH + 15 PR, In-Sem: 30 TH + 10 PR**

COURSE OBJECTIVES:

- To develop programming logic using C
- To solve Mathematical and logical problems using C
- To explore the use of arrays in different scenarios.
- To learn the Use of conditional statements and loops
- To implement pointers and dynamic memory allocation.

UNITS	CONTENTS	L	T	P	Total Hours
1 **(Marks)** **10 TH**	**Introduction to 'C' Language** Character set, Variables and Identifiers, Built-in Data Types, Variable Definition. Arithmetic operators and Expressions, Constants and Literals , Simple assignment statement, Basic input/output statement, Simple 'C' programs.	09	01	00	10
2 **(Marks)** **10 TH + 6 PR**	**Conditional Statements and Loops** Decision making within a program, conditions, Relational Operators, Logical Connectives, if statement, if-else statement, Loops: while loop, do while, for loop, Nested loops, Infinite loops, Switch statement, structures Programming.	09	01	10	20
3 **(Marks)** **12 TH + 6 PR**	**Arrays & Functions** One-dimensional arrays: Array manipulation; Two-dimensional arrays, Top-down approach of problem-solving, Modular programming and functions, Return Type, Function call, Block structure, Passing arguments to a Function: call by reference; call by value, Recursive Functions, arrays as function arguments.	10	02	10	22
4 **(Marks)** **6 TH + 3 PR**	**Structures** Structure variables, initialization, structure assignment, nested structure, structures and functions, structures and arrays: arrays of structures, structures containing arrays.	07	01	08	16
	Pointers & File Processing Address operators, pointer type declaration, pointer	06	01	00	07

5 (Marks) 7 TH	assignment, pointer initialization, pointer arithmetic, functions and pointers, Arrays and Pointers, pointer arrays. Concept of Files, File opening in various modes and closing of a file, Reading from a file, Writing onto a file.				
Total (in Hrs)		**41**	**06**	**28**	**75**

Where, L: Lectures T: Tutorials P: Practical

MODES OF IN-SEMESTER ASSESSMENT: (40 Marks)

- One Internal (TH) Examination - **10 Marks**
- One Internal (PR) Examination - **10 Marks**
- Others - **20 Marks**
  - Quiz
  - Seminar presentation
  - Assignment

COURSE OUTCOMES:

After the completion of this course, the learner will be able to:

CO1: Write programs using C as a language.
CO2: Explain the basic terminologies used in computer programming
CO3: Debug programs in C language.
CO4: Use different data types in a computer program.
CO5: Design programs involving decision structures, loops and functions.

SUGGESTED READINGS/REFERENCES:

1. Byron Gottfried "Programming with C" 4th edition,Tata McGraw-Hill, 2018.
2. E. Balaguruswami, "Programming with ANSI-C" 7th Edition,Tata McGraw Hill,2018.
3. Brian W. Kernighan, Dennis M. Ritchie, "The C Programming Language (Ansi C Version) " 2nd edition,Pearson Education India, 2015.
4. R.G. Dromey, "How to solve it by Computer",Pearson India, 2007.

Title of the Course : PROBLEM SOLVING USING C
Course Code : C - 1

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual Knowledge	CO1					
Conceptual Knowledge	CO2	CO1, CO2				CO4,CO5
Procedural Knowledge			CO1	CO3	CO1	CO5
Metacognitive Knowledge						CO1,CO5

Mapping of Course Outcomes to Program Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	S	S	S	S	S	S	M	S	L	L	S
CO2	S	M	M	M	M	S	M	S	S	M	M
CO3	S	S	S	S	S	S	M	S	M	M	M
CO4	S	S	S	S	M	S	M	S	M	L	M
CO5	S	S	S	S	S	S	M	S	L	L	S

Title of the Course	**:**	**CYBER SECURITY**
Course Code	**:**	**Minor - 1**
Nature of the Course	**:**	**Minor**
Total Credits	**:**	**04**
Distribution of Marks	**:**	**End-Sem :45 TH + 15 PR, In-Sem: 30 TH + 10 PR**

COURSE OBJECTIVES:

- To introduce the concept of cyberspace, internet governance, and cyber security issues and challenges.
- To familiarize with different types of cyber crimes, modus operandi of cyber criminals, and legal perspective of cyber crime.
- To enable to understand social media platforms, their challenges, opportunities, and pitfalls, and the security issues related to social media.
- To provide with an understanding of e-commerce and digital payments, their components, threats, and security best practices.
- To introduce to digital device security, password policy, security patch management, and Wi-Fi security and to familiarize with different tools and technologies for cyber security.

UNITS	CONTENTS	L	T	P	Total Hours
1 **(Marks)** **10TH**	**Introduction to Cyber security:** Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security.	06	01	-	07
2 **(Marks)** **10TH**	**Cyber crime and Cyber law** : Classification of cyber crimes, Common cyber crimes-cyber crime targeting computers and mobiles, cyber crime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi , Reporting of cyber crimes, Remedial and mitigation measures, Legal perspective of cyber crime, IT Act 2000 and its amendments, Cyber crime and offences, Organisations dealing with Cyber crime and Cyber security in India.	07	01	-	08
3 **(Marks)** **10TH+06PR**	**Social Media Overview and Security:** Introduction to Social networks. Types of Social media, Social media platforms, Social media monitoring, Hashtag, Viral content, Social media marketing, Social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Laws regarding	09	01	10	20

	posting of inappropriate content, Best practices for the use of Social media.				
4 **(Marks)** **08TH+06PR**	**Commerce and Digital Payments** Definition of E- Commerce, Main components of E-Commerce, Elements of E-Commerce security, E-Commerce threats, E-Commerce security best practices, Introduction to digital payments, Components of digital payment and stake holders, Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), e-Wallets, Unstructured Supplementary Service Data (USSD), Aadhar enabled payments, Digital payments related common fraudsand preventive measures. RBI guidelines on digital payments and customer protection in unauthorised banking transactions. Relevant provisions of Payment Settlement Act,2007	09	01	10	20
5 **(Marks)** **07TH +03PR**	**Digital Devices Security, Tools and Technologies for Cyber Security:** End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third party software, Device security policy, Cyber Security best practices, Significance of host firewall and Ant-virus, Management of host firewall and Anti-virus, Wi-Fi security, Configuration of basic security policy andpermissions.	09	01	10	20
	Total (in Hrs)	40	05	30	75

Where, L:Lectures T: Tutorials P: Practicals

MODES OF IN-SEMESTER ASSESSMENT: (40 Marks)

- One Internal (TH) Examination - **10 Marks**
- One Internal (PR) Examination - **10 Marks**
- Others - **20 Marks**
  - Quiz
  - Seminar presentation
  - Assignment

COURSE OUTCOMES:

After the completion of this course, the learner will be able to:

CO1: Understand the architecture of cyberspace, communication and web technology, internet infrastructure for data transfer and governance, and internet society.
CO2: Identify the different types of cyber crimes, their modus operandi, reporting and remedial measures, and the legal perspective of cyber crime in India.
CO3: Analyze social media platforms, their challenges, opportunities, and pitfalls, and the security issues related to social media.

CO4: Describe the different components of e-commerce and digital payments, their threats, and security best practices.
CO5: Apply digital device security, password policy, security patchmanagement, and Wi-Fi security best practices.
CO6: Use different tools and technologies for cyber security, such as host firewall, antivirus, and data backup.

SUGGESTEDREADINGS/ REFERENCES:

1. Cyber Crime Impact in the New Millennium, by R. C Mishra ,Auther Press. Edition 2010.
2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives bySumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011)
3. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A.Oliver, Create Space Independent Publishing Platform. (Pearson,13thNovember, 2001)
4. Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.

Title of the Course : **CYBER SECURITY**

Course Code : **Minor - 1**

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	**Remember**	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge						
Conceptual Knowledge		**CO1,CO2**	**CO2**	**CO2**	**CO4**	
Procedural Knowledge			**CO3**	**CO5**		
Meta cognitive Knowledge					**CO5**	

Mapping of Course Outcomes to Program Outcomes

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	**L**	**M**	**M**	**M**	**S**	**L**	**M**	**S**	**S**	**S**	**S**
CO2	**M**	**M**	**S**	**M**	**S**	**M**	**S**	**M**	**S**	**S**	**S**
CO3	**L**	**M**	**M**	**M**	**M**	**M**	**S**	**S**	**S**	**S**	**S**
CO4	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**S**
CO5	**S**	**S**	**M**	**S**	**M**	**M**	**L**	**L**	**L**	**L**	**S**

Title of the Course : OFFICE AUTOMATION TOOLS
Course Code : GEC – 1
Nature of the Course : GENERIC ELECTIVE
Total Credits : 03
Distribution of Marks : End- Sem : 45 TH + 15 PR, In-Sem: 30 TH + 10PR

COURSE OBJECTIVES:

- Install and configure office suite software such as Microsoft Office and Libre Office for various tasks.
- Format documents, create tables, and use drawing tools to develop advanced word processing skills.
- Utilize basic formulas and functions, create macros, and construct pivot tables in spreadsheets for dataanalysis.
- Design and deliver effective presentations by adding and formatting text, pictures, graphic objects, charts, and using transitions and animations.
- Explain the benefits and use of cloud office automation tools, specifically Office 365, in enhancing work efficiency.

UNITS	CONTENTS	L	T	P	Total Hours
1 (Marks) 5TH + 3 PR	**Introduction to office suite:** Installation and basics of MS office/Libre office	04	01	04	09
2 (Marks) 12TH + 3PR	**Word Processing:** Working with Documents- Formatting Documents - Setting Page style- Creating Tables - Drawing- Tools - Printing Documents - Operating with MS Word documents.	06	01	04	11
3 (Marks) 12TH + 3PR	**Spreadsheets:** Worksheets, Formatting data, creating charts and graphs, using basic formulas and functions, macros, Pivot Table	05	01	06	12
4 (Marks) 11TH + 3PR	**Presentation Tools:** Adding and formatting text, pictures, graphic objects, including charts, objects, formatting slides, notes, hand-outs, slide shows, using transitions, animations	05	01	06	12
5 (Marks) 5TH + 3 PR	**Cloud:** Introduction to cloud office automation using office-365.	05	01	10	16
	Total (in Hrs)	**25**	**05**	**30**	**60**

Where, L: Lectures T: Tutorials P: Practicals

MODES OF IN-SEMESTER ASSESSMENT: (40 Marks)

- One Internal(TH) Examination - **10 Marks**
- One Internal(PR) Examination - **10 Marks**
- Others - **20 Marks**
    - Quiz
    - Seminar presentation
    - Assignment

COURSE OUTCOMES:

After the completion of this course, the learner will be able to:

CO1: Install and configure Microsoft Office and Libre Office software for various tasks.
CO2: Use formatting options, create tables, and employ drawing tools in word processing documents.
CO3: Develop spreadsheets utilizing basic formulas and functions, create macros, and construct pivot tables to analyze data.
CO4: Design and produce effective presentations by adding and formatting text, pictures, graphic objects, including charts and objects, and formatting slides, notes, and hand-outs, and using transitions and animations.
CO5: Implement and utilize cloud-based office automation tools to enhance work efficiency and collaboration.

SUGGESTED READINGS:

1. SushilaM , Introduction to Essential tools,JBA,2009.
2. Wang, W. (2018). Office 2019 For Dummies. United States: Wiley.
3. Kumar, B. (2017). Mastering MS Office. India: V&S Publishers.
4. Kumar A, (2019) Computer Basics with Office Automation, Dreamtech Press, ISBN: 9789389447194, 9789389447194.

Title of the Course : OFFICE AUTOMATION TOOLS
Course Code : GEC – 1

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	**Remember**	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge		**CO1**				
Conceptual Knowledge		**CO1**	**CO2**			
Procedural Knowledge			**CO2, CO5**	**CO3**		**CO3, CO4**
Meta cognitive Knowledge			**CO5**	**CO3**		**CO3, CO4**

Mapping of Course Outcomes to Program Outcomes

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	**S**	**L**	**M**	**L**	**L**	**L**	**L**	**M**	**M**	**M**	**L**
CO2	**S**	**L**	**S**	**L**	**L**	**L**	**M**	**M**	**S**	**M**	**L**
CO3	**S**	**L**	**S**	**L**	**L**	**L**	**M**	**M**	**S**	**M**	**L**
CO4	**S**	**L**	**S**	**L**	**L**	**L**	**M**	**M**	**S**	**M**	**L**
CO5	**S**	**L**	**M**	**L**	**L**	**L**	**M**	**M**	**S**	**M**	**L**

Title of the Course	**:**	**HTML AND CMS TOOLS**
Course Code	**:**	**SEC - 1**
Nature of the Course	**:**	**Skill Enhancement Course**
Total Credits	**:**	**03**
Distribution of Marks	**:**	**End-Sem : 45 TH + 15 PR, In-Sem: 30 TH + 10 PR**

COURSE OBJECTIVES:

- Describe the history and foundational concepts of HTML.
- Write HTML code and display web pages in a browser.
- Utilize HTML tags and attributes effectively to structure content.
- Format web pages using basic HTML tags, formatting tags, and color coding.
- Explain the use of HTML lists, images, hyperlinks, tables, forms, and headers.
- Identify and describe the functionalities of popular CMS tools such as WordPress, Drupal, and Joomla.

UNITS	CONTENTS	L	T	P	Total Hours
1 (Marks) 8TH + 3 PR	**Introduction:** History of HTML, Software required for writing HTML code and viewing HTML webpage, HTML Tags and Attributes: HTML Tag vs. Element, HTML Attributes	04	01	04	09
2 (Marks) 10TH + 3PR	**HTML-Basic Formatting Tags:** HTML Basic Tags, HTML Formatting Tags, HTML Color Coding, HTML-Grouping Using Div Span, Div and Span Tags for Grouping	05	01	04	10
3 (Marks) 10TH + 3PR	**HTML-Lists:** Unordered Lists, Ordered Lists, Definition list **HTML-Images:** Image and Image Mapping **HTML-Hyperlink:** URL - Uniform Resource Locator, URL Encoding	05	01	06	12
4 (Marks) 7TH + 3 PR	**HTML-Table:** < table >,<th>,< tr >,< td >,< caption> ,<thead>,<tbody>,<tfoot>,<colgroup>,< col > **HTML-Form:** < input >, <textarea>, < button >, < select >, < label > **HTML-Headers:** Title, Base, Link, Styles, Script, Meta	05	01	06	12
5 (Marks) 10TH + 3PR	**CMS TOOLS:** Wordpress, Drupal, Joomla	06	01	10	17
	Total (in Hrs)	25	**05**	**30**	**60**

Where, ***L: Lectures*** ***T: Tutorials*** ***P: Practicals***

MODES OF IN-SEMESTER ASSESSMENT: **(40 Marks)**

- One Internal(TH) Examination - 1**0 Marks**
- One Internal(PR) Examination - **10 Marks**
- Others - **20 Marks**
    - Quiz
    - Seminar presentation
    - Assignment

COURSE OUTCOMES:

After the completion of this course, the learner will be able to:

CO1: Illustrate the history and importance of HTML.

CO2: Write HTML code and view HTML webpages using appropriate software.

CO3: Use HTML tags and attributes to create effective webpages.

CO4: Format webpages using basic HTML tags, formatting tags, and color coding.

CO5: Use HTML lists, images, hyperlinks, tables, forms, and headers to enhance their webpages.

SUGGESTED READINGS/ REFERENCES:

1. Huddleston, R. (2018), Introduction to HTML and CSS -- O'Reilly.
2. Jon Duckett (2019), HTML and CSS, John Wiely.
3. Minnick,J. (2015).WebDesignwithHTML5andCSS3(8thEdition).Cengage Learning.
4. James P. (2011), Professional Mobile Web Development with WordPress, Joomla! and Drupal, Wiley Publications, ISBN: 978-0-470-88951-0.

Title of the Course : HTML AND CMS TOOLS

Course Code : SEC - 1

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	**Remember**	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge	CO1	CO1				
Conceptual Knowledge		CO2	CO2, CO3, CO4, CO5			CO2, CO3, CO4, CO5
Procedural Knowledge		CO2	CO2, CO3, CO4, CO5			CO2, CO3, CO4, CO5
Metacognitive Knowledge						

Mapping of Course Outcomes to Program Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	L	L	M	L	L	L	S	L	L	L	S
CO2	S	S	M	L	S	M	S	S	S	S	S
CO3	S	S	M	M	S	M	S	S	S	S	S
CO4	S	S	M	M	S	M	S	S	S	S	S
CO5	S	S	M	M	S	M	S	S	S	S	S

Title of the Course	**:**	**DATABASE MANAGEMENT SYSTEM**
Course Code	**:**	**C - 2**
Nature of the Course	**:**	**Major**
Total Credits	**:**	**04**
Distribution of Marks	**:**	**End-Sem :45 TH + 15 PR, In-Sem: 30 TH + 10 PR**

COURSE OBJECTIVES:

- To learn Database Management Systems and their characteristics.
- To explore the concept of Conceptual Data Modeling using Entities and Relationships.
- To learn the Relational Model and its concepts, constraints, and update operations.
- To learn Database design techniques using ER and EER for relational mapping, functional dependencies, and normal forms.
- To familiarize with SQL and its data definition, constraints, retrieval queries, and data manipulation statements.

UNITS	CONTENTS	L	T	P	Total Hours
1 (Marks) 5 TH	**Introduction to Database Management Systems** Characteristics of database approach, data models, DBMS architecture and data independence. Advantages of using the DBMS approach.	08	02	00	10
2 (Marks) 8TH	**Conceptual Data Modeling using Entities and Relationships** Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, examples, Specialization and Generalization.	12	04	00	16
3 (Marks) 10 TH	**Relational Model** Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations.	10	05	00	15
4 (Marks) 10 TH + 7PR	**Database design** ER and EER to relational mapping, functional dependencies, normal forms up to third normal form	08	01	06	15
5 (Marks) 12TH + 8PR	**SQL** SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL.	08	01	10	19
	Total (in Hrs)	**46**	**13**	**16**	**75**

Where, ***L: Lectures*** ***T: Tutorials*** ***P: Practicals***

MODES OF IN-SEMESTER ASSESSMENT: **(40 Marks)**

- One Internal (TH) Examination - **10 Marks**
- One Internal (PR) Examination - **10 Marks**
- Others - **20 Marks**
  - Quiz
  - Seminar presentation
  - Assignment

COURSE OUTCOMES:

After the completion of this course, the learner will be able to:

CO1: Understand the characteristics of Database Management Systems and the advantages of using the DBMS approach.
CO2: Create Conceptual Data Models using Entities and Relationships, including entity types, entity sets, attributes, and roles.
CO3: Understand the Relational Model and its concepts, constraints, and update operations.
CO4: Design databases using ER and EER for relational mapping, functional dependencies, and normal forms up to the third normal form.
CO5: Write SQL statements for data definition, specifying constraints, retrieval queries, and data manipulation statements like INSERT, DELETE, and UPDATE.

SUGGESTED READINGS/ REFERENCES:

1. R. Elmasri, S.B. Navathe, Fundamentals of Database Systems 6th Edition, Pearson Education, 2016.
2. R. Ramakrishanan, J. Gehrke, Database Management Systems 3rd Mc Graw Hill, 2018
3. A. Silberschatz, H.F. Korth, S. Sudarshan, Database System Concepts 6th Edition, McGraw Hill, 2019.
4. H. G. Molina, J. Ullman, J. Widom, Database Systems: The Complete Book, Pearson, 2nd edition, 2008.

Title of the Course : DATABASE MANAGEMENT SYSTEM
Course Code : C - 2

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual Knowledge	CO2, CO5	CO1, CO3	CO4	CO5		CO2, CO4
Conceptual Knowledge		CO1, CO3	CO2, CO4, CO5	CO2, CO4, CO5	CO2, CO4, CO5	CO2, CO4, CO5
Procedural Knowledge	CO4		CO2, CO4, CO5	CO2, CO4	CO4, CO5	CO2, CO4, CO5
Metacognitive Knowledge		CO1, CO3	CO5		CO5	CO2, CO4

Mapping of Course Outcomes to Program Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	S	S	M	S	S	S	M	S	M	M	M
CO2	S	S	S	S	S	S	S	S	M	M	M
CO3	S	S	M	S	S	S	M	S	M	M	M
CO4	S	S	S	S	S	S	S	S	M	M	M
CO5	S	S	M	S	S	S	M	S	M	M	M

Title of the Course	**:**	**FOUNDATION OF COMPUTER SCIENCE**
Course Code	**:**	**Minor-2**
Nature of the Course	**:**	**Minor**
Total Credits	**:**	**04**
Distribution of Marks	**:**	**End- Sem: 45 TH + 15 PR, In-Sem: 30 TH + 10 PR**

COURSE OBJECTIVES:

- To discuss about basics of computers and their applications.
- To explain fundamental concepts of computer hardware and software.
- To discuss about different types of operating systems and their functions.
- To explore about different computer viruses.
- To familiar with a variety of computer applications, including word processing, spreadsheets, databases.

UNITS	CONTENTS	L	T	P	Total Hours
1 (Marks) 10 TH	**Introduction to computer and information technology:** Introduction to computers – definition, characteristics, capabilities and limitations, classification of computers, generation of computers.	08	01	00	09
2 (Marks) 10 TH	**Computer Organization and working:** Components of a computer system, input devices, output devices, computer memory.	10	01	00	11
3 (Marks) 10 TH	**Computer software:** Need of software, types of software, system software and application software. Programming languages: machine, assembly, high level, 4GL, their merits and demerits. Application software-word processing, spread sheet, presentation graphics, and database management software.	12	01	00	13
4 (Marks) 10 TH + 7PR	**Operating System:** Introduction to Operating Systems (Disk operating system, Windows, Linux, Unix). Introduction to computer virus. Basics of DOS and Unix commands, SHELL	10	01	10	21

	Programming, Basic Windows and Linux operations.				
5 (Marks) 5 TH + 8PR	**MS Office Suite:** Basics of Ms-Word, Ms-Excel, Ms-Power Point and Ms-Access.	10	01	10	21
Total (in Hrs)		**50**	**05**	**20**	**75**

where, ***L: Lectures*** ***T: Tutorials*** ***P: Practicals***

MODES OF IN-SEMESTER ASSESSMENT: (40 Marks)

- One Internal(TH) Examination - **10 Marks**
- One Internal(PR) Examination - **10 Marks**
- Others - **20 Marks**
  - Quiz
  - Seminar presentation
  - Assignment

COURSE OUTCOMES:

After the completion of this course, the learner will be able to:

CO1: Identify computer hardware and peripheral devices.

CO2: Familiar with software applications.

CO3: Understand the risks of different computer viruses.

CO4: Learn different DOS commands and SHELL Programming.

CO5: Apply the basic concepts of a word processing package, electronic spreadsheet and PowerPoint tool.

SUGGESTED READINGS/REFERENCES:

1. Sinha P.K., "Computer Fundamentals",BPB Publication, Sixth Edition, 2012.
2. Rajaraman,V.,"Computer Fundamentals*",*PHI, Sixth Edition, 2012.
3. Ram.B., "Computer Fundamentals:Architecture and Organization",New Age Publication, 5th Edition, 2013.
4. Goel.A., "Computer Fundamentals", Pearson Education, 2011 Reprint.
5. Sirivastava S.S, "Ms-Office", Laxmi Publication, 2015.

Title of the Course : FOUNDATION OF COMPUTER SCIENCE

Course Code : Minor-2

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	**Remember**	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge	CO1	CO1				
Conceptual Knowledge		CO2		CO3		
Procedural Knowledge		CO4	CO4, CO5			CO5
Metacognitive Knowledge						

Mapping of Course Outcomes to Program Outcomes

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	M	M	M	M	M	M	M	M	M	S	S
CO2	M	S	M	M	M	M	S	S	S	S	S
CO3	M	S	M	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S	S

Title of the Course	**:**	**BASIC HARDWARE MAINTENANCE**
Course Code	**:**	**GEC - 2**
Nature of the Course	**:**	**GENERIC ELECTIVE**
Total Credits	**:**	**03**
Distribution of Marks	**:**	**End -Sem : 45 TH + 15 PR, In-Sem:30 TH + 10 PR**

COURSE OBJECTIVES:

- Describe the various components of computer hardware and their functions.
- Explain the functioning of different hardware components within a computer.
- Assemble and disassemble computer hardware components effectively.
- Test and diagnose computer hardware components using appropriate techniques and tools.
- Use a multimeter to test and troubleshoot computer hardware components.

UNITS	CONTENTS	L	T	P	Total Hours
1 (Marks) 10TH + 2 PR	**Introduction to computer hardware:** Computer Hardware Overview, Block Diagram Details, Parts of Computer. Motherboard: Types, Block Diagram, Identification of Ports, Chip, Slots, Connector, Section etc. CPU: CPU Socket details, Types of CPU, Identification, Basic Terminology of CPU. RAM: of RAM, Identification of RAM, RAM Operating Voltage.	05	01	04	10
2 (Marks) 8TH + 4 PR	**SMPS:** Concept of Current, SMPS pin details, SMPS Voltage, Testing of SMPS, How to use Multimeter, Testing of Power Cable.	05	01	04	10
3 (Marks) 8TH + 2 PR	**Hard disk:** Hard disk Types, Identification of Hard disk, Jumper Setting, Warranty, Measuring concept etc.	05	01	06	12
4 (Marks) 8TH + 2 PR	**Keyboard and Mouse:** Types, Identification, Repairing of Keyboard and Mouse.	05	01	06	12
5 (Marks) 11TH + 5 PR	**Assembling and Dissembling** of Computer, Testing of all Parts of Computer.	05	01	10	16
	Total (in Hrs)	**25**	**05**	**30**	**60**

Where, ***L: Lectures*** ***T: Tutorials*** ***P: Practicals***

MODES OF IN-SEMESTER ASSESSMENT: **(40 Marks)**

- One Internal(TH) Examination - **10 Marks**
- One Internal(PR) Examination - **10 Marks**
- Others - **20 Marks**
    - Quiz
    - Seminar presentation
    - Assignment

COURSE OUTCOMES:

After the completion of this course, the learner will be able to:

CO1: Describe the different hardware components of a computer and their functions.
CO2: Identify and differentiate between different types of hardware components.
CO3: Assemble, dissemble, and test a computer system.
CO4: Use a multimeter to test the power supply unit (SMPS) and other hardware components.
CO5: Troubleshoot and repair common hardware issues with keyboard and mouse.

SUGGESTED READINGS/ REFERENCES:

1. Craig Zacker, John Rourke, PC Hardware: The Complete Reference, McGraw Hill Education; 1st edition (1 July 2017)
2. Stephen Bigelow, Troubleshooting, Maintaining & Repairing PCs , McGraw-Hill Education; 5th edition (2015)
3. Prajapat, Rahul. Field Technician - Computing & Peripherals (English Version): Computer Hardware and Maintenance. N.p.: Amazon Digital Services LLC - KDP Print US, 2018.

Title of the Course : BASIC HARDWARE MAINTENANCE

Course Code : GEC - 2

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	**Remember**	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge	CO1	CO1, CO2				
Conceptual Knowledge		CO1, CO2				
Procedural Knowledge		CO3	CO4, CO5			
Metacognitive Knowledge						

Mapping of Course Outcomes to Program Outcomes

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	L	L	M	M	M	M	M	M	M	L	M
CO2	L	M	M	M	M	M	S	S	S	L	M
CO3	S	S	S	S	S	S	S	S	S	L	M
CO4	L	M	M	S	S	M	S	S	S	L	M
CO5	S	S	S	S	S	S	S	S	S	L	M

Title of the Course : MULTIMEDIA APPLICATIONS AND TOOLS
Course Code : SEC - 2
Nature of the Course : SKILL ENHANCEMENT COURSE
Total Credits : 03
Distribution of Marks : End- Sem : 45 TH + 15 PR, In-Sem: 30 TH + 10 PR

COURSE OBJECTIVES:

- Identify the various components of multimedia and describe their functions.
- Explain the stages involved in creating multimedia projects.
- Describe the hardware, software, and authoring tools used in multimedia production.
- Use multimedia production tools such as Adobe Premiere Pro, DaVinci Resolve, and Photoshop to create and edit multimedia content.
- Evaluate different multimedia production tools and techniques to determine their effectiveness for various projects.

UNITS	CONTENTS	L	T	P	Total Hours
1 (Marks) 10TH + 3PR	**Multimedia:** Introduction to multimedia, Components, Uses of multimedia. **Making Multimedia:** Stages of a multimedia project, Requirements to make good multimedia, Multimedia Hardware - Macintosh and Windows production Platforms, Hardware peripherals - Connections, Memory and storage devices, Multimedia software and Authoring tools.	05	01	05	11
2 (Marks) 10TH + 3PR	**Text:** Fonts & Faces, Using Text in Multimedia, Font Editing& Design Tools, Hypermedia &Hypertext **Images:** Still Images – Bitmaps, Vector Drawing, 3D Drawing & rendering, Natural Light & Colors, Computerized Colors, Color Palletes, Image File Formats.	05	01	05	11
3 (Marks) 8TH + 3PR	**Sound:** Digital Audio, MIDI Audio, MIDI vs Digital Audio, Audio File Formats.	05	01	05	11
4 (Marks) 7TH + 3PR	**Video:** How Video Works, Analog Video, Digital Video, Video File Formats, Video Shooting and Editing.	05	01	10	16
5 (Marks) 10TH + 3PR	**Tools:** Adobe Premier Pro, DaVinci Resolve, Photoshop.	05	01	05	11
	Total (in Hrs)	25	**05**	**30**	**60**

Where, L: Lectures T: Tutorials P: Practicals

MODES OF IN-SEMESTER ASSESSMENT: **(40 Marks)**

- One Internal(TH) Examination - **10 Marks**
- One Internal(PR) Examination - **10 Marks**
- Others - **20 Marks**
    - Quiz
    - Seminar presentation
    - Assignment

COURSE OUTCOMES:

After the completion of this course, the learner will be able to:

CO1: Define multimedia and identify its components and uses.

CO2: Illustrate the stages involved in creating multimedia projects and the requirements needed to make good multimedia.

CO3: Use multimedia hardware, software, and authoring tools.

CO4: Use text, images, sound, video, and animation in multimedia production.

CO5: Illustrate digital and MIDI audio, different audio file formats, how video works,different video file formats, and video shooting and editing techniques.

CO6: Illustrate animation principles, techniques, and file formats.

CO7: Able to use multimedia production tools such as Adobe Premier Pro, DaVinci Resolve, and Photoshop to create multimedia projects.

SUGGESTED READINGS/ REFERENCES :

1. Tay Vaughan, “Multimedia: Making it work”, TMH, Eighth edition. 2014
2. Ralf Steinmetz and Klara Naharstedt, “Multimedia: Computing, Communications Applications”, Pearson,2015.
3. Keyes, “Multimedia Handbook”, TMH. 2017.
4. K. Andleigh and K. Thakkar, “Multimedia System Design”, PHI,2018

Title of the Course : MULTIMEDIA APPLICATIONS AND TOOLS
Course Code : SEC - 2

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	**Remember**	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge	CO1, CO5	CO2, CO5, CO6				
Conceptual Knowledge	CO1	CO2, CO5, CO6				
Procedural Knowledge			C03, CO4, CO7			CO7
Metacognitive Knowledge						

Mapping of Course Outcomes to Program Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	L	L	M	L	M	M	L	L	L	L	L
CO2	L	L	M	L	M	M	L	M	M	M	L
CO3	S	S	S	L	S	M	S	S	S	S	S
CO4	S	S	S	L	S	M	S	S	S	S	S
CO5	L	L	M	L	L	L	M	L	L	L	L
CO6	L	L	M	L	L	L	M	L	L	L	L
CO7	S	S	S	M	S	S	S	S	S	S	S

Title of the course : **DIGITAL DESIGN**
Course code : **C-3**
Nature of the course : **Major**
Total credits :**04**
Distribution of Marks : **End- Sem: 45TH + 15 PR , In-Sem:30 TH + 10 PR**

COURSE OBJECTIVES:

- To introduce the fundamental concept of digital design.
- To explain how to represent and manipulate decimal numbers in different coding systems.
- To familiarize with the concept of logic gates and their functions.
- To introduce with combinational and sequential logic design and building blocks.

UNITS	CONTENTS	L	T	P	Total Hours
1 (Marks) 09 TH	**Representation of information:** Review of number systems and their conversions: Binary, Decimal, Octal and Hexadecimal; Positive and negative numbers, Gray codes.	08	02	-	10
2 (Marks) 09TH	**Arithmetic operations and Character codes:** Addition, subtraction, multiplication, division of numbers,1's complement, 2's complement of binary numbers, subtraction by using 1's complement and 2's complement methods. BCD, ASCII, Codes for error detection and correction, Concept of hamming distance.	08	03	-	11
3 (Marks) 09TH + 08 PR	**Logic Design:** Boolean algebra & Switching functions, Minimization and Realization using logic gates. Representation of logic functions-SOP and POS ,K-map presentation.	08	04	10	22
4 (Marks) 09TH + 07PR	**Combinational circuits:** Designing of Combinational circuits: Adder, Subtractor, Multiplexers, Demultiplexers, Decoders, Encoders.	08	04	10	22
5 (Marks) 09 TH	**Sequential circuits:** Sequential logic: Latch, Flip flops, Registers and Counters.	08	02	-	10
	Total (in Hrs)	40	15	20	75

Where, L: Lectures T: Tutorials P: Practicals

MODES OF IN-SEMESTER ASSESSMENT: (40Marks)

- One Internal(TH) Examination - **10 Marks**
- One Internal(PR) Examination - **10 Marks**
- Others(Anyone) - **20Marks**
    - Quiz
    - Seminar presentation
    - Assignment

COURSE OUTCOMES:

After the completion of this course, the learner will be able to:

CO1: Learn about different number systems.
CO2: Simplify simple logic functions.
CO3: Create simple logic circuit using logic gates.
CO4: Explain how to design combinational logic circuits.
CO5: Understand how to design sequential logic circuits.

SUGGESTEDREADINGS/REFERNCES:

1. Morris M.M, "Digital Logic and Computer Design", Pearson,2022
2. Wakerly J.F.," Digital Design: Principles and Practices", Pearson,5th Edition,2021
3. Kohavi,Z Jha N.K, "Switching Finite automata theory,3/e" Cambridge,2018
4. Salivahanan.S and Arivazhagan.S, "Digital Circuits and Design",Vikas Publishing House PVT LTD,5th Edition,2018

Title of the course : **DIGITAL DESIGN**
Course code : **C-3**

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual Knowledge	CO5	CO1				
Conceptual Knowledge		CO5	CO1,CO3	CO2,CO5		CO4
Procedural Knowledge		CO2,CO4				CO3
Metacognitive Knowledge		CO1,CO3				

Mapping of Course Outcomes to Program Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M	M	M	S	M	M	M	L	S	L	M
CO2	M	M	S	S	S	M	M	M	M	M	M
CO3	S	M	M	S	S	M	M	M	M	M	M
CO4	S	M	M	S	M	M	M	M	S	M	M
CO5	M	M	M	S	M	M	M	M	S	L	M

Title of the Course	**:**	**DATA STRUCTURE**
Course Code	**:**	**C - 4**
Nature of the Course	**:**	**Major**
Total Credits	**:**	**04**
Distribution of Marks	**:**	**End- Sem :45 TH + 15 PR, In-Sem:30 TH + 10 PR**

COURSE OBJECTIVES:

- To learn the major algorithms in data structures.
- To analyse the performance of algorithms.
- To explore which algorithm or data structure to use in different scenarios.
- To learn the properties of various data structures such as stacks, queues, lists, and trees.
- To learn and explore various sorting algorithms, including bubble sort, insertion sort, selection sort, heap sort, merge sort, and quick sort.
- To learn various searching algorithms.

UNITS	CONTENTS	L	T	P	Total Hours
1 (Marks) 10 TH + 6 PR	**Introduction & Basic of Data Structure** Data structure, algorithms, Primitive and Composite data types, Time and Space Complexity of Algorithms, Linked List, Stack, Queues implementation using Array and linked list, Insertion, Deletion, and Traversal of linked list. Recursion and its implementation regarding stack.	09	01	10	20
2 (Marks) 10 TH + 6 PR	**Sorting& Searching Algorithms** Introduction to Sorting and its practical use, Sorting Algorithms and its implementation Bubble sort, Insertion sort, Selection Sort, Quick sort, Merge sort, and Radix Sort. Introduction to Searching algorithms, Linear search, Binary search, depth-first search, and breadth-first search techniques.	09	01	10	20
3 (Marks) 12 TH + 3 PR	**Introduction to Trees** Introduction to Trees, properties of Trees, Binary Tree, Complete Binary Trees, Binary search Trees, Tree traversal methods(pre-order, in order, post order),Infix, Postfix and Prefix Notations, the basic concept of Heap	10	02	8	20

4 (Marks) 4 TH	**Hashing and Collision** Hash tables, Hash functions, collisions, collision resolution	07	01	00	08
5 (Marks) 9 TH	**File Structure** Concept of Fields, Records and Files, Blocks, Clusters, Sectors. Indexing Structures for Files: Types of Single-level Ordered Indexes, Multilevel Indexes.	06	01	00	07
Total (in Hrs)		**41**	**06**	**28**	**75**

Where, L: Lectures T: Tutorials P: Practical

MODES OF IN-SEMESTER ASSESSMENT: (40 Marks)

- One Internal (TH) Examination - **10 Marks**
- One Internal (PR) Examination - **10 Marks**

- Others - **20 Marks**
  - Quiz
  - Seminar presentation
  - Assignment

COURSE OUTCOMES:

After the completion of this course, the learner will be able to:

CO1	Calculate the time and space complexity of algorithms
CO2	Use an array or linked list in different scenarios.
CO3	Differentiate between linear and non-linear data structures.
CO4	Apply non-linear data structure in appropriate areas.
CO5	Explain hashing and collision resolution methods.
CO6	Apply various sorting and searching algorithms to different problems.

SUGGESTED READINGS/REFERENCES:

1. A. M. Tenenbaum , Y. Langsam , M. J. Augenstein ,Data Structure using C, Pearson Education , 1st Edition, 2019.
2. Lipschutz Seymour"Data Structures with C", T. M. Hill,2017.
3. Weiss, Mark Allen ,"Data Structures and Algorithm Analysis in C++",Pearson,4thEdition,2013

Title of the Course : DATA STRUCTURE

Course Code : C - 4

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	**Remember**	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge	CO1			CO3		
Conceptual Knowledge	CO6	CO5	CO1, CO4, CO6	CO3	CO1	CO2, CO4
Procedural Knowledge		CO4, CO6	CO4, CO6		CO1, CO6	CO2, CO4
Metacognitive Knowledge		CO5	CO1	CO6		

Mapping of Course Outcomes to Program Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	S	S	S	S	S	S	S	S	M	M	M
CO2	S	S	S	S	S	M	M	S	M	L	M
CO3	S	S	S	S	S	S	S	S	M	L	M
CO4	S	S	S	S	S	S	S	S	M	L	M
CO5	M	S	S	M	M	M	M	S	M	L	M
CO6	S	S	S	S	S	S	S	S	M	L	M

Title of the Course	**:**	**DATA STRUCTURE AND PROGRAMMING PARADIGMS**
Course Code	**:**	**Minor - 3**
Nature of the Course	**:**	**Minor**
Total Credits	**:**	**04**
Distribution of Marks	**:**	**End- Sem :60TH , In-Sem :40TH**

COURSE OBJECTIVES:

- Illustrate the fundamental concepts of data structures and programming paradigms.
- Develop skills in implementing and manipulating various data structures.
- Analyze and compare different programming paradigms and their applications.
- Apply appropriate data structures and programming paradigms to solve computational problems.
- Evaluate algorithms in terms of time complexity and space complexity.

UNITS	CONTENTS	L	T	P	Total Hours
1 (Marks) 8 TH	**Introduction:** Elementary data organization, Data Structure definition, Data type vs. data structure, Categories of data structures, Data structure operations, Applications of data structures, Algorithms complexity and time-space tradeoff.	07	01	00	08
2 (Marks) 12TH	**Arrays & Linked Lists:** Arrays: Introduction, Linear arrays, Representation of linear array in memory, Traversal, Insertions, Deletion in an array with algorithm, Multidimensional arrays. Linked List: Introduction, Array vs. linked list, Representation of linked lists in memory, Traversal, Insertion, Deletion, Searching in a linked list with algorithm, Headerlinked list, Circular linked list, Two-way linked list.	12	01	00	13
3 (Marks) 15TH	**Stack & Queue:** Stack: primitive operation on stack, algorithms for push and pop. Representation of Stack as Linked List and array, Stacks applications: polish notation, recursion. Introduction to queues, Primitive Operations on the Queues, Circular queue, Priority queue, Representation of Queues as Linked List and array, Applications of queue. Algorithm on insertion and deletion in simple queue and circular queue.	12	01	0	13
4 (Marks) 15TH	**Trees** Trees - Basic Terminology, representation, Binary Trees, Tree Representations using Array & Linked List, Basic operation on Binary tree, Traversal of binary	12	01	0	13

	trees:- In order, Preorder & post order, Applications of Binary tree. Binary Search Tree, Insertion and Deletion in binary search tree, Applications of binary search tree. Concept of Heap, Application of heap.				
5 (Marks) 10 TH	**Programming Paradigms** Introduction to programming paradigms: Imperative, Declarative, Alternative, procedural, object oriented, functional, and logic & rule based, Role of programming languages, Use of programming paradigms, Characteristics of good programming languages. Introduction to objects, entity diagrams, UML.	12	01	00	13
	Total (in Hrs)	**55**	**05**	**00**	**60**

Where, L: Lectures T: Tutorials P: Practicals

MODES OF IN-SEMESTER ASSESSMENT: (40 Marks)

- Two Internal(TH) Examination - **20 Marks**
- Others - **20 Marks**
  - Quiz
  - Seminar presentation
  - Assignment

COURSE OUTCOMES:

After the completion of this course, the learner will be able to:

CO1: Differentiate between various data types and data structures.
CO2: Develop algorithms for common operations on arrays, linked lists, stacks, queues, and trees.
CO3: Evaluate the efficiency of algorithms in terms of time and space complexity.
CO4: Design and implement abstract data types using appropriate data structures.
CO5: Assess the suitability of different programming paradigms for solving specific computational problems.

SUGGESTED READINGS/REFERENCES:

1. Venkatesan, R., & Lovelyn Rose, S. “Data Structures”, 2nd Edition. Wiley, 2019.
2. Salaria, R. S. “Data Structures”, 3rd Edition. Khanna Publishing, 2017.
3. Tucker, A., Noonan, R. , “Programming Languages: Principles and Paradigms”, 2nd Edition. McGraw Hill Education, 2017.
4. Gabbrielli, Maurizio, et al. Programming Languages: Principles and Paradigms. Germany, Springer International Publishing, 2023.

Title of the Course : **DATA STRUCTURE AND PROGRAMMING PARADIGMS**

Course Code : **Minor – 3**

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual Knowledge	CO2	CO1		CO3	CO3	
Conceptual Knowledge	CO4	CO5	CO1, CO4	CO3, CO5	CO3	CO2, CO4
Procedural Knowledge		CO4	CO4	CO5	CO2	CO2, CO4
Metacognitive Knowledge		CO5	CO1			

Mapping of Course Outcomes to Program Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	S	S	M	S	M	S	M	S	M	M	M
CO2	S	S	S	S	S	M	M	S	M	L	M
CO3	S	S	M	S	M	S	S	S	M	L	M
CO4	S	S	S	S	S	S	S	S	M	L	M
CO5	S	S	M	S	M	S	M	S	M	L	M

Title of the Course	**:**	**BASICS OF PHOTOSHOP**
Course Code	**:**	**GEC - 3**
Nature of the Course	**:**	**GENERIC ELECTIVE**
Total Credits	**:**	**03**
Distribution of Marks	**:**	**End Sem : 45 TH + 15 PR, In-Sem: 30 TH + 10 PR**

COURSE OBJECTIVES:

- To introduce the Photoshop interface and tools.
- To familiarize with importing and saving files in Photoshop.
- To provide an understanding of layers, masks, and selections in Photoshop.
- To introduce the basic retouching tools in Photoshop.
- To provide an understanding of color correction tools and text in Photoshop.

UNITS	CONTENTS	L	T	P	Total Hours
1 (Marks) 8TH + 3 PR	**Introduction to Photoshop Interface and Tools:** Introduction to the Photoshop interface, Understanding the different tools and palettes, Setting up a workspace.	05	01	03	09
2 (Marks) 10TH + 3 PR	**Importing and Saving Files:** Importing files into Photoshop, Understanding file formats and resolutions, Saving files in different formats.	05	01	03	09
3 (Marks) 10TH + 3 PR	**Working with Layers, Masks, and Selections:** Understanding layers and how to use them, Creating masks and selections, Understanding the difference between raster and vector graphics.	05	01	03	09
4 (Marks) 7TH + 3 PR	**Basic Retouching Tools:** Using the spot healing brush tool, Using the clone stamp tool, Understanding the patch tool.	05	01	10	16
5 (Marks) 10TH + 3PR	**Color Correction Tools and Text:** **U**nderstanding color modes, Using the curves tool, Using the levels tool, Using the hue/saturation tool, Creating text layers, Formatting text, Applying effects to text.	05	01	11	17
	Total (in Hrs)	**25**	**05**	**30**	**60**

Where, L: Lectures T: Tutorials P: Practicals

MODES OF IN-SEMESTER ASSESSMENT: **(40 Marks)**

- One Internal(TH) Examination - **10 Marks**
- One Internal(PR) Examination - **10 Marks**
- Others - **20 Marks**
    - Quiz
    - Seminar presentation
    - Assignment

COURSE OUTCOMES:

After the completion of this course, the learner will be able to:

CO1: Navigate and utilize the Photoshop interface and tools.

CO2: Import and save files in Photoshop and understand different file formats and resolutions.

CO3: Work with layers, masks, and selections in Photoshop.

CO4: Retouch images using basic tools such as the spot healing brush tool, clone stamp tool, and patch tool.

CO5: Apply color correction techniques using tools such as curves, levels, and hue/saturation, and create and format text layers in Photoshop.

SUGGESTED READINGS/ REFERENCES :

1. McCathren, S. "Photoshop for Beginners: The Ultimate Guide to Learning Adobe Photoshop for Beginners", CreateSpace Independent Publishing Platform, (2019).
2. Andrews, P. , "Photoshop CC Basics for Photographers: Getting Started with Photoshop CC", CreateSpace Independent Publishing Platform, (2017).
3. Addison, T. , "Photoshop CC Essentials: A Beginner's Guide To Adobe Photoshop" Creative Cloud. Independently published, (2018).
4. Evening, M. , "Adobe Photoshop CC Classroom in a Book (2015 release)"Adobe Press.
5. Faulkner, A. , "Real World Adobe Photoshop CC for Photographers", Peachpit Press, (2018).

Title of the Course : BASICS OF PHOTOSHOP

Course Code : GEC - 3

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	**Remember**	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge						
Conceptual Knowledge	**CO1**	**CO1,CO2**	**CO3**			
Procedural Knowledge		**CO3**	**CO4, CO5**			
Metacognitive Knowledge						

Mapping of Course Outcomes to Program Outcomes

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**M**
CO2	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**M**
CO3	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**M**
CO4	**S**	**S**	**M**	**S**	**S**	**S**	**M**	**S**	**M**	**M**	**M**
CO5	**S**	**S**	**M**	**S**	**M**	**S**	**M**	**S**	**M**	**M**	**S**

Title of the Course	**:**	**DIGITAL FLUENCY**
Course Code	**:**	**VAC-3 (OPTION 1)**
Nature of the Course	**:**	**VALUE ADDED COURSE**
Total Credits	**:**	**02**
Distribution of Marks	**:**	**End- Sem : 20 TH + 10 PR, In-Sem: 10 TH + 10 PR**

COURSE OBJECTIVES:

- To introduce the concept of digital fluency and its importance in today's world.
- To provide an understanding of computer basics, including hardware, software, and operating systems.
- To familiarize with internet and web browsing, including search engines, email, and social media.
- To teach about online safety, including cyber security threats, protecting personal information, and safe online behavior.

UNITS	CONTENTS	L	T	P	Total Hours
1 (Marks) 5TH + 2 PR	**Introduction to Digital Fluency** Understanding digital fluency, Importance of digital fluency, Skills required for digital fluency	02	01	08	11
2 (Marks) 5TH + 2 PR	**Computer Basics** Introduction to computer hardware and software, Basic computer components and their functions, Basics of Operating system and file management, Internet and Web Browsing.	04	01	08	13
3 (Marks) 10 TH + 6 PR	**Introduction to the Internet, email and Social Media** Navigating the web, Search engines and search strategies, Creating and managing email accounts, Composing, and sending emails, Email etiquette and best practices, Introduction to social media platforms, Privacy, and security settings, Creating and managing social media accounts, Posting, and sharing content.	06	01	14	21
	Total (in Hrs)	**12**	**03**	**30**	**45**

Where, L: Lectures T: Tutorials P: Practicals

MODES OF IN-SEMESTER ASSESSMENT: **(20 Marks)**

- One Internal(TH) Examination - **5 Marks**
- One Internal(PR) Examination - **10 Marks**
- Others - **5 Marks**
    - Quiz
    - Seminar presentation
    - Assignment

COURSE OUTCOMES:

After the completion of this course, the learner will be able to:

CO1: Define digital fluency and identify the skills required to be digitally fluent.

CO2: Identification of computer hardware and software, including operating systems and file management.

CO3: Navigate the web, perform effective online searches, and create and manage email accounts.

CO4: Create and manage social media accounts, understand privacy and security settings, and post and share content.

CO5: Illustrate online safety and be able to identify and mitigate cyber security risks.

SUGGESTED READINGS:

1. Acharya, S., Chellappan, S., "Big Data Analytics", Wiley Publications 2015.
2. R. Thareja, "Computer Fundamentals and Programming in C," New Delhi, India: Oxford University Press, 2021.
3. R. P. Jain and S. K. Jain, "Introduction to Information Technology," New Delhi, India: Firewall Media, 2015.
4. K. D. Tripathi, "Social Media: Concepts, Practices and Trends," New Delhi, India: PHI Learning Pvt. Ltd., 2020.
5. N. K. Venkateswaran, "Cyber Security and Digital Forensics: A Practical Approach," Boca Raton, FL: CRC Press, 2018.
6. S. Gandhi and R. Sharma, "Digital Privacy and Security," New Delhi, India: Springer Nature Singapore Pte Ltd, 2021.

Title of the Course : DIGITAL FLUENCY
Course Code : VAC-3 (OPTION 1)

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	**Remember**	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge	CO1,		CO1, CO2			
Conceptual Knowledge	CO1,	CO4, CO5	CO1, CO2, CO5			
Procedural Knowledge			CO3			CO3, CO4
Metacognitive Knowledge						

Mapping of Course Outcomes to Program Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	L	L	M	L	L	L	S	M	L	L	M
CO2	L	L	M	L	L	L	S	M	M	L	M
CO3	S	M	M	M	S	L	S	M	M	S	M
CO4	S	M	M	M	S	L	S	M	M	S	S
CO5	L	L	M	M	S	L	S	M	M	S	M

Title of the Course : DIGITAL AND TECHNOLOGICAL SOLUTIONS
Course Code : VAC-3 (OPTION 2)
Nature of the Course : VALUE ADDED COURSE
Total Credits : 02
Distribution of Marks : End Sem : 20 TH + 10 PR, In-Sem: 10 TH + 10 PR

COURSE OBJECTIVES:

- To provide advanced digital skills and knowledge.
- To develop critical thinking and problem-solving abilities in the digital realm.
- To prepare leaders in the digital landscape.
- To enhance employability by providing relevant and in-demand digital skills.

UNITS	CONTENTS	L	T	P	Total Hours
1 (Marks) 5TH + 2PR	**Advanced Internet Skills** Advanced search techniques and web development using HTML, CSS, and JavaScript, Understanding, and using web APIs, Building a responsive website.	02	01	08	11
2 (Marks) 5TH + 2PR	**Digital Media and Content Creation** Advanced photo editing using Photoshop or GIMP, Video and audio editing using Final Cut Pro or Adobe Premiere Pro, Creating digital content for marketing and branding.	04	01	08	13
3 (Marks) 10 TH + 6PR	**Cyber security, Digital Privacy and Data Analytic** Advanced encryption techniques for data security, Understanding and mitigating advanced cyber threats, Implementing advanced digital privacy measures. Advanced data analysis using Excel or Tableau, understanding data visualization, and creating compelling visualizations, analyzing complex data sets to derive insights.	06	01	14	21
	Total (in Hrs)	**12**	**03**	**30**	**45**

Where, L: Lectures T: Tutorials P: Practicals

MODES OF IN-SEMESTER ASSESSMENT: **(20 Marks)**

- One Internal(TH) Examination - **5 Marks**
- One Internal(PR) Examination - **10 Marks**
- Others - **5 Marks**
    - Quiz
    - Seminar presentation
    - Assignment

COURSE OUTCOMES:

After the completion of this course, the learner will be able to:

CO1: Utilize advanced search techniques and web development tools to create responsive websites
CO2: Implement digital media editing including photos, videos, and audio using advanced software
CO3: Implement advanced cybersecurity and privacy measures to protect digital assets
CO4: Analyze complex data sets using Excel or Tableau and create compelling visualizations
CO5: Lead digital transformation and drive innovation in organizations

SUGGESTED READINGS/ REFERENCES :

1. P. N. Thomas and A. Raghuramaraju, "Digital India: Understanding Information, Communication and Social Change," New Delhi, India: Sage Publications India Pvt Ltd, 2017.
2. R. Thareja, "Computer Fundamentals and Programming in C," New Delhi, India: Oxford University Press, 2021.
3. R. P. Jain and S. K. Jain, "Introduction to Information Technology," New Delhi, India: Firewall Media, 2015.
4. K. D. Tripathi, "Social Media: Concepts, Practices and Trends," New Delhi, India: PHI Learning Pvt. Ltd., 2020.
5. N. K. Venkateswaran, "Cyber Security and Digital Forensics: A Practical Approach," Boca Raton, FL: CRC Press, 2018.
6. S. Gandhi and R. Sharma, "Digital Privacy and Security," New Delhi, India: Springer Nature Singapore Pte Ltd, 2021.

Title of the Course : DIGITAL AND TECHNOLOGICAL SOLUTIONS

Course Code : VAC-3 (OPTION 2)

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	**Remember**	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge						
Conceptual Knowledge		**CO1, CO2**	**CO3**	**CO4**	**CO4**	**CO5**
Procedural Knowledge		**CO1, CO2**	**CO3**		**CO4**	
Metacognitive Knowledge						**CO5**

Mapping of Course Outcomes to Program Outcomes

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	**M**	**M**	**S**	**M**	**S**	**L**	**M**	**S**	**S**	**S**	**S**
CO2	**M**	**M**	**S**	**M**	**S**	**M**	**S**	**M**	**S**	**S**	**S**
CO3	**L**	**M**	**M**	**M**	**M**	**M**	**S**	**S**	**S**	**S**	**S**
CO4	**S**	**M**	**M**	**M**	**S**	**S**	**S**	**S**	**M**	**M**	**M**
CO5	**S**	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**M**	**M**	**S**

Title of the Course	**:**	**BASICS OF PAGEMAKER**
Course Code	**:**	**SEC - 3**
Nature of the Course	**:**	**SKILL ENHANCEMENT COURSE**
Total Credits	**:**	**03**
Distribution of Marks	**:**	**End Sem : 45 TH + 15 PR, In-Sem: 30 TH + 10 PR**

COURSE OBJECTIVES:

- Describe the Adobe PageMaker interface and its key features.
- Create a new document and set up page layouts effectively in Adobe PageMaker.
- Add and format text, create paragraph styles, and utilize text boxes efficiently.
- Import, resize, crop images, and wrap text around images in documents.
- Draw shapes, use line tools, and operate the pen tool to enhance page design.
- Utilize master pages, create columns and grids, and apply color and swatches in document layouts.
- Export documents to PDF, set up print options, and troubleshoot common printing issues.

UNITS	CONTENTS	L	T	P	Total Hours
1 (Marks) 7TH + 3 PR	**Introduction to PageMaker** Overview of PageMaker Interface, Creating a New Document, Setting up Page Layouts	05	01	05	11
2 (Marks) 10TH + 3PR	**Working with Text** Adding and Formatting Text, Working with Text Boxes, Creating Paragraph Styles	05	01	05	11
3 (Marks) 10TH + 3PR	**Working with Images** Importing Images, Resizing and Cropping Images, Wrapping Text around Images	05	01	05	11
4 (Marks) 10TH + 3PR	**Working with Shapes , Lines , Page Layout and Design** Drawing Shapes, Working with Line Tools, Using the Pen Tool, Working with Master Pages, Creating Columns and Grids, Using Color and Swatches	05	01	05	11
5 (Marks) 8 TH + 3 PR	**Exporting and Printing** Exporting to PDF, Setting up Print Options, Troubleshooting Printing Issues	05	01	10	16
	Total (in Hrs)	**25**	**05**	**30**	**60**

Where, ***L: Lectures*** ***T: Tutorials*** ***P: Practicals***

MODES OF IN-SEMESTER ASSESSMENT: **(40 Marks)**

- One Internal(TH) Examination - **10 Marks**
- One Internal(PR) Examination - **10 Marks**
- Others - **20 Marks**
    - Quiz
    - Seminar presentation
    - Assignment

COURSE OUTCOMES:

After the completion of this course, the learner will be able to:

CO1: Navigate the Adobe PageMaker interface and create a new document.
CO2: Set up page layouts, and work with text boxes and paragraph styles effectively.
CO3: Import, manipulate images, and wrap text around them.
CO4: Create and edit shapes and lines using various tools.
CO5: Design and layout pages using master pages, columns, and grids.

SUGGESTED READINGS/ REFERENCES :

1. Bouton, G.D. , "Desktop publishing with PageMaker", San Francisco: Sybex, 1990.
2. Gruman, G. & Ventana Press. , "PageMaker 6.5 for Windows for dummies" ,Foster City, CA: IDG Books, (1997).
3. Alspach, T. "PageMaker 6.5 Plus for Windows: Visual QuickStart Guide.", Berkeley, CA: Peachpit Press, (1998).
4. Adobe Creative Team, "Adobe PageMaker 7.0 Classroom in a book" San Jose, CA: Adobe Press. (2002).
5. Alspach, T. , "PageMaker 7.0 for Windows and Macintosh: Visual QuickStart Guide"., Berkeley, CA: Peachpit Press, (2001).

Title of the Course : BASICS OF PAGEMAKER
Course Code : SEC - 3

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	**Remember**	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge	CO1, CO2, CO3, CO4, CO5					
Conceptual Knowledge						
Procedural Knowledge	CO1, CO2, CO3. CO4, CO5					CO1, CO2, CO3, CO4, CO5
Metacognitive Knowledge						

Mapping of Course Outcomes to Program Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	S	S	M	L	M	M	M	S	S	M	S
CO2	S	S	M	L	M	M	M	S	S	M	S
CO3	S	S	M	L	M	M	M	S	S	M	S
CO4	S	S	M	L	M	M	M	S	S	M	S
CO5	S	S	M	L	M	M	M	S	S	M	S

Title of the Course : **NUMERICAL ANALYSIS**

Course Code : **C-5**

Nature of the Course : **Major**

Total Credits :**04**

Distribution of Marks : **End-Sem:60TH, In-Sem:40TH**

COURSE OBJECTIVES:

- Learn to analyze and quantify errors in numerical computations.
- Learn techniques for interpolating data, approximating functions.
- Understand the role of linear algebra in numerical analysis.
- Explore techniques for numerical integration and differentiation.
- Acquire proficiency in applying numerical methods to solve a wide range of problems.

UNITS	CONTENT	L	T	P	Total Hours
1 **(12Marks)**	**Solution of Nonlinear Equation** Introduction, Types of equation, Errors in Computing, The Bisection Method, False Position Method, Newton Raphson Method, Solution of system of Nonlinear Equation, Fixed Point Iteration and Convergence.	10	02	-	12
2 **(12Marks)**	**Interpolation and Approximation** Introduction, Errors in Polynomial Interpolation, Lagrange's Polynomial, Newton's Interpolation Methods, Least Square Method for Linear and Nonlinear Data	10	02	-	12
3 **(12Marks)**	**Numerical Differentiation and Integration** Introduction to Numerical Differentiation, Newton's Differentiation Formula, Numerical Integration(Trapezoidal Rule, Simpson's 1/3 Rule, 3/8 Rule)	08	03	-	11
4 **(12Marks)**	**Solution of Linear Algebraic Equations** Review of the Existence of Solutions and Properties of Matrices, Consistency of a Linear System of Equations, Gaussian Elimination Method, Gauss Jordan Method, Inverse of Matrix using Gauss Elimination Method, Iterative Methods (Jacobi and Gauss-Seidel Iteration), Power Method.	10	03	-	13
5 **(12Marks)**	**Solution of Ordinary Differential Equations** Introduction to Differential Equation, Initial Value Problem, Taylor's Series Methods, Picard's Method, Euler's Method	10	02	-	12
	Total(in Hrs)	**48**	**12**	**-**	**60**

Where, L:Lectures T: Tutorials P:Practicals

MODES OF IN-SEMESTER ASSESSMENT: **(40 Marks)**

- Two Internal Examination - **20 Marks**
- Others - **20 Marks**
    - Quiz
    - Seminar presentation
    - Assignment

COURSE OUTCOMES:

After successful completion of this course, learners will be able to:

CO1: Demonstrate a solid understanding of fundamental numerical methods.

CO2:Identify sources of error in numerical computations and apply strategies to minimize errors effectively.

CO3: Interpret numerical results, drawing meaningful conclusions.

CO4: Analyze numerical solutions critically, evaluating their accuracy, stability for specific problems.

CO5: Solve ordinary differential equations using numerical methods

SUGGESTED READINGS/ REFERENCES:

1. Shankar R.,"Numerical Methods: Principles, Analysis, and Algorithms", Pearson Education India,2008.
2. Sastry S.S.,"Numerical Analysis", Prentice Hall India Learning.2011.
3. Burden R.L. and Faires J. D."Numerical Analysis", Cengage Learning,2010.
4. Chakra S.C. and Canale R.P., "Numerical Methods for Engineers",McGraw-Hill Education, 2010.

Title of the Course **: NUMERICAL ANALYSIS**

Course Code **: C-5**

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual Knowledge	CO1	CO1				
Conceptual Knowledge			CO2	CO3		
Procedural Knowledge				CO4	CO5	CO5
Metacognitive Knowledge					CO4	

Mapping of Course Outcomes to Program Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	S	M	S	M	S	M	S	S	S	M	M
CO2	S	S	M	M	S	M	S	M	S	M	M
CO3	S	M	S	S	S	M	S	M	M	M	S
CO4	S	S	S	S	S	M	S	S	S	M	S
CO5	M	M	S	S	S	M	S	S	S	M	S

Title of the Course	**:**	**OPERATING SYSTEM**
Course Code	**:**	**C-6**
Nature of the Course	**:**	**Major**
Total Credits	**:**	**04**
Distribution of Marks	**:**	**End-Sem:60 TH, In-Sem: 40** TH

COURSE OBJECTIVES:

- To introduce the basic concepts, types, functions, general working, and evolution of Operating Systems.
- To explain the process management in Operating Systems and its various components.
- To discuss different scheduling mechanisms and strategies used in Operating Systems.
- To discuss memory management in Operating Systems and its various techniques.
- To introduce shell and various editors present in Linux.
- To explain shell scripting, decision making, loops, and functions in shell.

UNIT	CONTENTS	L	T	P	Total Hours
1 (10 Marks)	**Introduction:** Need and Evolution of Operating System, Types of Operating System, Functions of Operating System, General Working of Operating System, General Structure of Operating System.	10	02	-	12
2 (15 Marks)	**Process Management:** System view of the process and resources, initiating the OS, process address space, process abstraction, resource abstraction, process hierarchy, Thread model.	10	02	-	12
3 (10 Marks)	**Scheduling:** Scheduling Mechanisms, Strategy selection, non-pre-emptive and pre-emptive strategies.	08	02	-	10
4 (10 Marks)	**Memory Management:** Mapping address space to memory space, memory allocation strategies, fixed partition, variable partition, paging, and virtual memory.	10	03	-	13
5 (15 Marks)	**Shell Introduction and Shell Scripting:** Shell and its types, Various editors present in Linux, modes of operation in vi editor, shell script, Writing and execution of the shell script, shell variable(user-defined and system variables), System calls, Using system calls, Pipes and Filters, Decision making (If-else, switch), Loops, and functions in shell Scripts, Utility programs(cut, paste, join, tr, uniqutilities), Pattern matching utility(grep)	10	03	-	13
	Total (in Hrs)	**48**	**12**	**-**	**60**

Where, ***L: Lectures*** ***T: Tutorials*** ***P: Practical***

MODES OF IN-SEMESTER ASSESSMENT: **(40 Marks)**

- Two Internal Examination - **20 Marks**
- Others - **20 Marks**
    - Quiz
    - Seminar presentation
    - Assignment

COURSE OUTCOMES:

After the completion of this course, the learner will be able to

CO1. Understand the basic concepts and evolution of Operating Systems.
CO2. Differentiate between the types of Operating Systems and their functions.
CO3. Understand the process management in Operating Systems and its various components.
CO4. Explain the different scheduling mechanisms and strategies used in Operating Systems.
CO5. Understand the memory management in the Operating System and its various techniques.
CO6. Execute shell scripts.

SUGGESTED READINGS/ REFERENCES:

1. A Silberschatz, P.B. Galvin, G. Gagne, "Operating Systems Concepts", John Wiley Publications, 2011.
2. A.S. Tanenbaum, "Modern Operating Systems", 3rd Edition, Pearson Education, 2013.
3. G. Nutt, "Operating Systems: A Modern Perspective", 2nd Edition Pearson Education, 1997.
4. W. Stallings, "Operating Systems, Internals & Design Principles",5th Edition, Prentice Hall of India, 2015.

Title of the Course : OPERATING SYSTEM

Course Code : C-6

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	**Remember**	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge	CO1	CO1				
Conceptual Knowledge	CO1, CO3, CO5	CO1, CO2, CO3, CO4, CO5	CO6	CO2		
Procedural Knowledge						
Metacognitive Knowledge						

Mapping of Course Outcomes to Program Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	L	L	M	L	L	L	S	L	L	L	S
CO2	L	L	M	M	L	L	S	M	M	L	S
CO3	L	L	M	L	L	L	S	L	L	L	S
CO4	L	L	M	M	M	L	S	M	M	L	S
CO5	L	L	M	L	L	L	S	L	L	L	S
CO6	S	S	M	M	S	M	S	S	S	M	S

Title of the course : **OBJECT ORIENTED PROGRAMMING USING C++**
Course code : **C-7**
Nature of the course : **Major**
Total credits **04**
Distribution of Marks : **End Sem: 45 TH + 15 PR, In-Sem:30 TH + 10 PR**

COURSEOBJECTIVES:

- To introduce Object Oriented Programming concepts using the C++ language.
- To explain templates and exception handling
- To describe the principles of inheritance
- To use virtual functions and polymorphism
- To design problem-solving codes using the object-oriented approach through C++.

UNITS	CONTENTS	L	T	P	Total Hours
1 (Marks) 8 TH + 01 PR	**Fundamentals of C++:** Introduction to object oriented programming, user defined types, polymorphism, and encapsulation. Getting started with C++ - syntax, data-type, variables, strings, functions, exceptions and statements, namespaces and exceptions, operators. Flow control, functions, recursion. Arrays and pointers, structures.	07	01	00	08
2 (Marks) 10 TH + 05 PR	**Classes, objects and Operator overloading:** C++ extension to structures, member access operators static members, array of objects, returning objects from functions, Friend functions, pointers tomembers, friend classes, stack class, Default constructors, overloaded constructors, constructors with default arguments, copy constructors, dynamic constructor, destructor Defining operator overloading, operator function as member function and friend function, overloading unary and binary operators, type conversions, function Overloading	08	01	06	15
3 (Marks) 10 TH + 04 PR	**Templates and Exception Handling:** String template, instantiation, template parameters type checking, function template, template argument deduction, specifying template arguments, function template overloading, default template arguments, specialization, conversions. Error handling, grouping of exceptions, catching exceptions, catch all, re-throw, resource management, auto ptr, exceptions and new, resource exhaustion, exceptions in constructors, exception in destructors, uncaught exceptions, standard exceptions.	09	01	10	20
4 (Marks)	**Inheritance, virtual Functions and Polymorphism:** Types of inheritance, Defining derived class, Access specifiers, public and private inheritance, accessing	09	01	10	20

10 TH + 04 PR	base class members, ambiguity in multiple inheritance, virtual base classes, abstract classes, Derived class constructor with arguments, initialization lists in constructors, classes within classes. Virtual functions, pure virtual functions, abstract classes, implementation of virtual functions, this pointer, static and dynamic binding, virtual functions in derived classes, object slicing, virtual functions and constructors, calling virtual functions from destructors, virtual base classes, Rules for virtual functions.				
5 (Marks) 07TH + 01 PR	**File handling:** Basics of file handling in C++, classes for stream operations, operation on files, file opening modes, file pointer, error handling during file operations.	06	01	05	12
	Total (in Hrs)	**40**	**05**	**30**	**75**

where, ***L:Lectures*** ***T: Tutorials*** ***P:Practicals***

MODESOFIN-SEMESTER ASSESSMENT: **(40Marks)**

- One Internal(Theory) Examination- **10Marks**
- One Internal(Theory) Examination- **10Marks**
- Others(Anyone) - 2**0Marks**
  - Quiz
  - Seminar presentation
  - Assignment

COURSE OUTCOMES:

After the completion of this course, the learner will be able to:

CO1: Explain Object Oriented Programming concepts using the C++ language

CO2: Contrast object oriented programming with procedure based programming

CO3: Use templates to write generic programs

CO4: Design problem solving codes using virtual functions and polymorphism

CO5: Construct C++ program to solve real life problems

SUGGESTEDREADINGS/REFERENCES:

1. Herbert, S., 'C++: the Complete Reference', 4th edition, McGraw Hill Education, 2017.
2. Kanetkar Y., 'Let Us C++', BPB Publications; 14th edition, 2016
3. Thareja R.,'Object Oriented Programming with C++', Oxford University Press, 2015.
4. Balagurusamy, E. 'Object Oriented Programming with C++', McGraw Hill Education, 6th Edition, 2013.

Title of the course : **OBJECT ORIENTED PROGRAMMING USING C++**
Course code : **C-7**

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	**Remember**	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge		**CO1**				
Conceptual Knowledge		**CO1**		**CO1, CO2**		
Procedural Knowledge		**CO1, CO2**	**CO3**	**CO1, CO2**		**CO4, CO5**
Meta cognitive Knowledge						**CO4, CO5**

Mapping of Course Outcomes to Program Outcomes

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	**L**	**L**	**S**	**S**	**S**	**M**	**M**	**M**	**L**	**M**	**M**
CO2	**M**	**M**	**M**	**M**	**L**	**L**	**M**	**L**	**L**	**M**	**L**
CO3	**S**	**S**	**M**	**S**	**M**	**M**	**M**	**M**	**L**	**M**	**S**
CO4	**S**	**S**	**M**	**S**	**M**	**M**	**L**	**S**	**L**	**M**	**S**
CO5	**S**	**S**	**S**	**S**	**M**	**M**	**L**	**S**	**L**	**M**	**S**

Title of the course : COMPUTER ARCHITECTURE
Course code : C-8
Nature of the course : Major
Total credits :04
Distribution of Marks : End- Sem: 45TH + 15 PR, In-Sem: 30 TH + 10 PR

COURSE OBJECTIVES:

- To give an overview of the basic structure and operation of a digital computer.
- To introduce different computer memory.
- To explain about the different ways of communicating with I/O devices and standard I/O interfaces.
- To introduce students with assembly language programming.

UNITS	CONTENTS	L	T	P	Total Hours
1 (Marks) 09TH + 02 PR	**Introduction to Computers:** Von Neumann Architecture, generation of computers, capabilities and limitations, types of computers: Analog, Digital, Hybrid, General, Special purpose, Micro, Mini, Mainframe, Super computers, Personal computers, types of personal computers – Laptop, Palmtop etc.	06	01	03	10
2 (Marks) 09 TH + 02 PR	**Organization of a Computer:** Central Progressing Unit (CPU), Register, Stack, Simple ALU organization, Control Unit: Hardwired and Micro-programmed Control.	08	01	04	13
3 (Marks) 09TH	**Memory Organization:** Primary memory, Secondary memory, Cache Memory, Mapping, Virtual memory: address translation virtual to physical.	09	01	--	10
4 (Marks) 09TH	**I/O Organization:** Modes Of Transfer: Programme driven, Interrupt driven I/O, DMA, Input Output Processor (IOP), Peripherals, Bus system	08	02	--	10
5 (Marks) 09 TH + 11 PR	**Assembly language programming:** Addressing modes, Instruction formats, Instruction types, Assembly language programming of microprocessor 8085.	08	01	22	31
	Total (in Hrs)	40	05	30	75

Where, L:Lectures T: Tutorials P:Practicals

MODES OF IN-SEMESTER ASSESSMENT: 40Marks

- One Internal(Theory) Examination **-10Marks**
- One Internal(Theory) Examination **-10Marks**
- Others(Anyone) - **20Marks**
    - Quiz
    - Seminar presentation
    - Assignment

COURSE OUTCOMES:

After successful completion of this course, the learner will be able to:

CO1: Understand the basic structure, operation, and characteristics of digital computer.
CO2: Describe different components of a computer.
CO3: Describe the memory systems including cache memory and virtual memory.
CO4: Write simple assembly language program.
CO5: Understand different ways of communicating with I/O devices and standard I/O interfaces.

SUGGESTEDREADINGS/REFERENCES:

1. Mano M.M, "Computer System Architecture",Pearson,3rd Edition Revised,2017.
2. Hamacher.V.C.,Vranestic, Z.G. and Zaky, S.G. "Computer Organization", McGraw- Hill,6th Edition, 2022.
3. Hamacher.C.,Vranestic Z., Zaky S.,Manjikian N. "Computer Organization & Embedded Systems", McGraw- Hill International, 6th Edition,2023.
4. Ram.B., "Fundamentals of Microprocessors and Microcomputers", 5th Edition, Dhanpat Rai Publications, 2018.

Title of the course : COMPUTER ARCHITECTURE

Course code : C-8

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	**Remember**	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge	CO2,CO4	CO1, CO3				
Conceptual Knowledge		CO1, CO3,CO5	CO2,CO4	CO2, CO3	CO3	
Procedural Knowledge			CO4	CO1,CO5		
Metacognitive Knowledge						

Mapping of Course Outcomes to Program Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	S	M	S	S	S	M	M	M	S	L	M
CO2	S	M	S	S	M	M	S	M	S	L	M
CO3	M	M	S	S	S	M	S	M	S	L	M
CO4	S	M	S	S	S	M	S	M	S	M	M
CO5	M	M	S	S	S	M	M	M	M	M	M

Title of the course : **OPERATING SYSTEMS AND NETWORK MANAGEMENT**
Course code : **Minor-4**
Nature of the course : **Minor**
Total credits **04**
Distribution of Marks : **End-Sem:60TH, In-Sem: 40 TH**

COURSE OBJECTIVES:

- To introduce the concepts associated with operating system and their design considerations.
- To provide necessary tools for choosing operating system for certain environment.
- To understand the networking concepts.
- To expose the relationship between operating systems and computer networks.

UNITS	CONTENTS	L	T	P	Total Hours
1 (12 Marks)	**Introduction to Operating System :** Serial Processing, Batch Processing, Multiprogramming, Operating System Structure, Layered Structure Approach, Virtual Machine, Client-Server Model, Kernel Approach, Classification of Advanced Operating System, Characteristics of Modern Operating System, Microkernel Architecture, Multithreading, Symmetric Multiprocessing.	06	01	04	11
2 (12 Marks)	**Introduction to Networking Concepts :** Reference models, network topologies, types of network, transmission media, IP addressing, internetworking devices, media access control.	07	01	03	11
3 (12 Marks)	**Linux Operating System:** Features of Linux, components of Linux, Memory Management subsystems Linux Process and Thread Management, File Management System, Device Drivers, Linux commands Utilities and Editor ,Some Useful Commands, Permission Modes and Standard Files, Pipes, Filters and Redirection, Shell Scripts, Graphical User Interface, Editor.	08	01	05	14
4 (12 Marks)	**Windows 2000 networking :**Windows 2000 Operating System Architecture and services, managing Windows 2000 Server ,Using Windows 2000 and Client, Advanced Windows 2000 Networking.	06	01	05	12
5 (12 Marks)	**Windows XP Networking :** Introduction to Windows XP Networking, TCP/IP Protocol Setting for Windows XP, Virtual Private Networks and Remote Networking, Sharing Files in Windows XP, Sharing Folders in Windows XP, Sharing Drives in Windows XP, Enabling Offline File Features.	06	01	05	12
	Total (in Hrs)	33	05	22	60

Where, ***L: Lectures*** ***T: Tutorials*** ***P: Practicals***

MODES OF IN-SEMESTER ASSESSMENT: **(40 Marks)**

- Two Internal Examinations - **20 Marks**
- Others - **20 Marks**
    - o Quiz
    - o Seminar presentation
    - o Assignment

COURSE OUTCOMES:

After successful completion of this course, learners will be able to

CO1: Classify different types of OS.

CO2: Compare different approaches to OS design;

CO3: Explain computer networks and their applications.

CO4: Configure Linux OS for a machine as a domain name server and a network file server;

CO5: Describe the concept of distributed file system.

CO6: Configure and manage network devices.

SUGGESTEDREADINGS/REFERENCES

1. Tanenbaum, Andrew S.; Woodhull, Albert S., Operating Systems. Design and Implementation, Upper Saddle River, N.J.: Pearson/Prentice Hall, 2006, ISBN0-13-142938-8.
2. Behrouz A. Forouzan, Data Communication and Networking, 4th Edition, TMH 2004.
3. Gouglas Comer, Internetworking with TCP/IP, Volume 1, 4th Edition, Prentice Hall, 2000.
4. Resource Kit, Windows 2000 Professional, Microsoft Press.
5. https://www.redhat.com/docs/manuals/linux.
6. https://www.linux.org.
7. https://www.microsoft.com.

Title of the course : **OPERATING SYSTEMS AND NETWORK MANAGEMENT**
Course code : **Minor-4**

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	**Remember**	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge						
Conceptual Knowledge		**CO1,CO2**	**CO2**	**CO2**	**CO4**	
Procedural Knowledge			**CO3**	**CO5**		
Meta cognitive Knowledge					**CO5**	**CO6**

Mapping of Course Outcomes to Program Outcomes

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	**L**	**M**	**M**	**M**	**S**	**L**	**M**	**S**	**S**	**S**	**S**
CO2	**M**	**M**	**S**	**M**	**S**	**M**	**S**	**M**	**S**	**S**	**S**
CO3	**L**	**M**	**M**	**M**	**M**	**M**	**S**	**S**	**S**	**S**	**S**
CO4	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**S**
CO5	**S**	**S**	**M**	**S**	**M**	**M**	**L**	**L**	**L**	**L**	**S**
CO6	**S**	**S**	**S**	**S**	**S**	**S**	**L**	**M**	**S**	**S**	**M**

Title of the Course : **MATHEMATICAL FOUNDATION FOR COMPUTER SCIENCE**
Course Code : **C -9**
Nature of the Course : **Major**
Total Credits :**04**
Distribution of Marks : **End-Sem:60 TH, In-Sem:40TH**

COURSE OBJECTIVES:

- Familiarize the concepts of mathematical structures that are fundamentally discrete.
- Provide an overview of sets, relations and functions; and their associated operations.
- Introduce formal reasoning and proof techniques.
- Study combinatorial analysis techniques
- Illustrate the relevance of discrete mathematics concepts and techniques to various areas of computer science.

UNITS	CONTENT	L	T	P	Total Hour
1 (12 Marks)	Set Theory and Ordered Sets: Basic concept of set theory, Operations with Sets, Function, Relations, Properties of Relations, Representing Relations, Composition of Relations, Closures of Relations, Ordered Sets, Hasse Diagrams of Partially Ordered Sets	10	02	-	12
2 (12Marks)	Ordering Relations, Lattices and Boolean Algebra: Partial Ordering Relations; Equivalence Relations, Lattices, Bounded Lattices, Distributive Lattices, Complements, Complemented Lattices, Introduction to Boolean algebra (basic Concept).	10	02	-	12
3 (12Marks)	Counting Principles: Basic Counting Principles (Sum and Product Rule); Pigeonhole Principle (without proof) - Simple examples; Permutations and Combinations: Permutation without and with repetition-examples; Permutation with Identical Objects-examples;Combination without and with repetition-examples;	08	03	-	11
4 (12 Marks)	Mathematical Logic: Statements and Notations, Connectives, Normal forms, Equivalences, Predicate calculus, Quantifiers, Inference theory of the predicate calculus.	10	03	-	13
5 (12Marks)	Graph Theory: Basic terminology, models and types, multigraphs and weighted graphs, graph representation, graph isomorphism, connectivity, Euler and Hamiltonian Paths and Circuits, planar graphs, graph coloring, Trees, basic terminology and properties of Trees, introduction to spanning trees.	10	02	-	12
	Total (in Hrs)	**48**	**12**	**-**	**60**

where, ***L: Lectures*** ***T: Tutorials*** ***P: Practicals***

MODES OF IN-SEMESTER ASSESSMENT: **(40 Marks)**

- Two Internal Examination - **20 Marks**
- Others - **20 Marks**
    - Quiz
    - Seminar presentation
    - Assignment

COURSE OUTCOMES:

After successful completion of this course, learners will be able to:

CO1: Define mathematical structures and use them to model real life situations.
CO2: Understand, construct and solve simple mathematical problems.
CO3: Apply combinatorial analysis techniques to analyze data structures, algorithms.
CO4: Develop an attitude to solve problems based on graphs and trees.
CO5: Apply discrete mathematical techniques to analyze and solve problems encountered in computer science.

SUGGESTED READINGS/REFERENCES:

1. Seymour Lipschutz and Marc Lars Lipson, Discrete Mathematics, Fourth Edition Schaum's Outline Series, McGraw Hill, 2022.
2. Kenneth H. Rosen, Discrete Mathematics and Its Applications, Seventh Edition, McGraw Hill, 2012.
3. Swapan K Sarkar, A Textbook of Discrete Mathematics, 9th Edition, S Chand & Co Ltd, 2016.
4. Mohapatra, & Liu, C.L., "Elements of Discrete mathematics", 4th edition. McGraw Hill Education,2012.
5. Rosen,K.H., "Discrete Mathematics and Its Applications",7th edition. Tata McGraw Hill Education,2011.

Title of the Course : MATHEMATICAL FOUNDATION FOR COMPUTER SCIENCE

Course Code : C -9

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual Knowledge	CO1	CO1				
Conceptual Knowledge		CO2	CO3	CO3	CO2	
Procedural Knowledge				CO4	CO5	
Metacognitive Knowledge						CO4

Mapping of Course Outcomes to Program Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	S	M	S	M	S	M	S	S	S	M	M
CO2	S	S	M	M	S	M	S	M	S	M	M
CO3	S	S	S	S	S	S	S	M	M	S	S
CO4	S	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S	S

Title of the course : **DESIGN AND ANALYSIS OF ALGORITHMS**
Course code : **C-10**
Nature of the course : **Major**
Total credits :**04**
Distribution of Marks : **End Sem : 45 TH + 15 PR, In-Sem: 30 TH + 10 PR**

COURSEOBJECTIVES:

- To understand the basic principles of algorithm design.
- To create strong logic and problem solving approach.
- To learn important algorithm design paradigms and how they can be used to solve various real world problems
- To familiarize the students with fundamental problem-solving strategies like searching, recursion and help them to evaluate efficiencies of various algorithms.
- To write rigorous correctness proofs for algorithms.
- To explore the theoretical background of the basic data structures.

UNITS	CONTENTS	L	T	P	Total Hours
1 (Marks) 8TH	**Introduction to algorithms** Basic Design and Analysis techniques of Algorithms, Order notations, mathematical induction, recurrence relations.	09	01	00	10
2 (Marks) 10TH+3PR	**Algorithm design techniques** Iterative techniques, Divide and Conquer, Dynamic Programming, Greedy Algorithms	09	01	9	18
3 (Marks) 10TH+6PR	**Graph Algorithms and Searching Techniques** Sortest path, MST, Topological Sorting, Maximum Flow, Searching Techniques, Medians & Order Statistics, complexity analysis	09	01	10	20
4 (Marks) 8 TH	**NP-completeness** Classes P and NP, reduction, NP-completeness, examples of NP-complete problems.	09	01	0	13
5 (Marks) 9TH + 6PR	**Approximation algorithms** Introduction to Approximation algorithms, TSP, The Vertex-Cover Problem.	09	01	06	14
	Total (in Hrs)	45	05	25	75

Where, L:Lectures T: Tutorials P:Practicals

MODESOFIN-SEMESTERASSESSMENT: (40Marks)

- One Internal (TH) Examination - 10 Marks
- One Internal (PR) Examination - 10 Marks
- Others - 20 Marks
  - Quiz
  - Seminar presentation
  - Assignment

COURSE OUTCOMES:

After the completion of this course, the learner will be able to:

CO1: Understand and evaluate efficiency of the programs that they write based on performance of the algorithms used.
CO2: Analyze the efficiency of the algorithms.
CO3: Implement and know the applications of algorithms for sorting, pattern matching etc.
CO4: Select, decide and apply appropriate design principle by understanding the requirements of any real life problems.
CO5: Explain what competitive analysis is and to which situations it applies
CO6: Write algorithms choosing the best one or a combination of two or more of the algorithm design techniques

SUGGESTEDREADINGS/REFERENCES:

1. E. L., Charles. H. C., Thomas. L. R., Ronald S. Clifford. "Introduction to Algorithms", 3rd Edition, PHI Learning Pvt. Ltd., 2019.
2. S., Sridhar "Design and Analysis of Algorithms", Oxford University Press, 1st Edition, 2019.
3. I., Mohan, Chandra. "Design and Analysis of Algorithms", PHI Learning Pvt. Ltd, 2nd edition, 2010.
4. L, Anany. "Introduction to the Design and Analysis of Algorithms", Pearson, 3rd Edition, 2011.

Title of the course : **DESIGN AND ANALYSIS OF ALGORITHMS**
Course code : **C-10**

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual Knowledge		CO2	CO3		CO1	
Conceptual Knowledge	CO3	CO5		CO1	CO3	CO6
Procedural Knowledge	CO4	CO1	CO4		CO3	CO5
Metacognitive Knowledge		CO1	CO6	CO2	CO5	

Mapping of Course Outcomes to Program Outcomes

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	S	S	M	M	M	S	S	S	M	M	M
CO2	M	M	S	S	S	M	M	M	M	M	S
CO3	M	M	M	M	M	S	S	S	M	S	S
CO4	S	S	S	S	S	M	M	M	S	M	S
CO5	M	M	M	S	S	S	S	M	M	M	M
CO6	S	S	M	M	S	S	M	M	M	S	S
CO7	M	M	M	M	S	S	S	S	S	S	M

Title of the Course	**:**	**FORMAL LANGUAGE AND AUTOMATA**
Course Code	**:**	**C-11**
Nature of the Course	**:**	**Major**
Total Credits	**:**	**04**
Distribution of Marks	**:**	**End-Sem:60 TH, In-Sem:40 TH**

COURSE OBJECTIVES:

- To introduce the theoretical foundations of computer science from the perspective of formal languages.
- To explain finite state machines and how they solve problems in computing.
- To define different formal language classes and their relationships.
- To introduce the concept of Push Down Automata and the Turing Machine.

UNIT	CONTENTS	L	T	P	Total Hours
1 (15Marks)	**Finite Automata:** Finite Automata, Transitions and Its properties, Acceptability by Finite Automaton, Introduction to Nondeterministic Finite Automata, equivalence of NFA (Nondeterministic Finite Automata) and DFA (Deterministic Finite Automata), Minimization of finite Automata, Finite Automata with output -Mealy and Moore Machines.	12	3	-	15
2 (15Marks)	**Regular Sets and Regular Grammar:** Introduction, Kleene closure, Formal definition, Algebra of regular expression, Regular languages, closure properties of regular set, Finite automata and Regular Expressions.	12	3	-	15
3 (15Marks)	**Context Free Grammar:** Grammar and its classification, CFG, Normal Forms of Context free Grammar, Ambiguity in CFG and Parsing. Push down automata (PDA), Basic Structure of PDA, Acceptance by PDA, Correspondence between PDA and CFL.	12	3	-	15
4 (15Marks)	**Chomsky Hierarchy and Turing Machine:** CSL and LBA, Formal definition of Turing Machine, Transition diagram, Basic structure and working of Turing Machine, language of Turing Machine, Types of Turing Machine, universal Turing Machine, Chomsky Hierarchy.	12	3	-	15
	Total (in Hrs)	**48**	**12**	**-**	**60**

Where, L: Lectures T: Tutorials P: Practicals

MODES OF IN-SEMESTER ASSESSMENT: (40 Marks)

- Two Internal Examination - **20 Marks**
- Others - **20 Marks**
  - Quiz
  - Seminar presentation
  - Assignment

COURSE OUTCOMES:

After the completion of this course, the learner will be able to

CO1. Understand Automata theory and its application in Computer Science.
CO2. Recognize different formal language classes.
CO3. Classify different types of grammars for formal languages.
CO4. Understand the basic structure and working of Pushdown Automata
CO5. Understand how a Turing Machine performs computations.

SUGGESTED READINGS/ REFERENCES:

1. Linz P ,"An Introduction to Formal Language and Automata", Jones and Bartlett Publishers, Inc. , USA, 2011.
2. Misha, K. L. P. "Theory of Computer Science: Automata, Languages and Computation" PHI, 3rd Edition, 2009
3. Nagpal C. K, "Formal Languages And Automata Theory",Oxford University Press, 2011
4. Hopcroft, J. E.; Motwani, R; Ullman, J.D, "Introduction To Automata Theory, Language And Computation", Addison –Weisley, 3rd edition, 2013.

Title of the Course : FORMAL LANGUAGE AND AUTOMATA

Course Code : C-11

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	**Remember**	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge	CO1, CO2	CO1, CO4, CO5				
Conceptual Knowledge		CO3, CO4, CO5	CO2	CO3		
Procedural Knowledge						
Metacognitive Knowledge						

Mapping of Course Outcomes to Program Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	L	L	M	L	L	L	S	L	L	L	S
CO2	L	L	M	M	M	L	S	L	L	L	S
CO3	M	L	M	M	M	L	S	M	M	L	S
CO4	L	L	M	M	M	L	S	L	L	L	S
CO5	L	L	M	M	M	L	S	L	L	L	S

Title of the course : **DIGITAL SYSTEMS AND COMPUTER ARCHITECTURE**
Course code : **Minor-5**
Nature of the course : **Minor**
Total credits :**04**
Distribution of Marks : **60TH (End Sem) + 40 TH (In-Sem)**

COURSE OBJECTIVES:

- To understand different logical circuits.
- To familiarize the students with I/O devices and their controllers
- To understand basic computer architecture and design.
- To learn about CPU architecture and instruction execution process.

UNITS	CONTENTS	L	T	P	Total Hours
1 (12Marks)	**Introduction:** Logic gates, Boolean algebra, Combinational circuits, Circuit simplification, Flip-flops and Sequential circuits, Decoders, Multiplexers, Registers, Counters	11	02	-	13
2 (12Marks)	**Data Representation and Basic Computer Arithmetic:** Number systems, Complements, Fixed and floating-point representation, Character representation, Magnitude-comparison, Multiplication, Division algorithms for integers	09	03	-	12
3 (12Marks)	**Basic Computer Organization and Design:** Computer memory- RAM, ROM, Cache memory, Virtual memory,Registers, Instruction cycle, Input-output and Interrupt, Priority schemes - daisy chaining,Interrupt masking	09	02	-	11
4 (12Marks)	**CPU Architecture** Instruction format-operand,Addressing formats; Addressing modes-direct,indirect,immediate,relative, indexed, Instruction execution process - fetch and execution cycles, RISC vs CISC	08	04	-	12
5 (12Marks)	**I/O Architecture:** Characteristics of simple I/O devices their controllers; I/O interface, Data transfer synchronization, Computer BUS, Bus arbitration mechanism; Concept of I/O channels and peripheral processor.	09	03	-	12
	Total (in Hrs)	46	14	00	60

Where, L:Lectures T: Tutorials P:Practicals

MODESOFIN-SEMESTERASSESSMENT: **(20Marks)**

- One Internal Examination - **10Marks**
- Others(Anyone) - **10Marks**
  - Quiz
  - Seminar presentation
  - Assignment

COURSE OUTCOMES:

After the completion of this course, the learner will be able to:

CO1: Explain different number systems.
CO2: Define the structure and design of combinational circuits and sequential circuits.
CO3: Explain different computer architectures and hardware.
CO4: Evaluate problems of digital logic.
CO5: Understand CPU architecture and execution process.
CO6: Explain bus organization and bus arbitration process.

SUGGESTEDREADINGS/ REFERENCES:

1. Morris.M.M, "Digital Logic and Computer Design", Pearson,2022
2. Hamacher.V.C.,Vranestic, Z.G. and Zaky, S.G. "Computer Organization", McGraw-Hill,5th Edition, 2011.
3. Salivahanan.S and Arivazhagan.S, "Digital Circuits and Design",Vikas Publishing House PVT LTD,4th Edition,2012
4. Hamacher.C.,Vranestic Z., Zaky S.,Manjikian N. "Computer Organization & Embedded Systems", McGraw- Hill International, 6th Edition,2023.
5. Ram.B., "Fundamentals of Microprocessors and Microcomputers", 5th Edition, Dhanpat Rai Publications, 2018.

Title of the course : **DIGITAL SYSTEMS AND COMPUTER ARCHITECTURE**
Course code : **Minor-5**

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual Knowledge	CO1,CO3	CO2,CO5,CO6				
Conceptual Knowledge		CO1,CO3,CO6	CO4,CO5	CO2		
Procedural Knowledge		CO2,CO5		CO1,CO3	CO4	
Metacognitive Knowledge		CO5	CO4			

Mapping of Course Outcomes to Program Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M	M	S	S	S	M	M	L	S	L	M
CO2	M	M	S	S	S	M	M	L	S	L	M
CO3	S	M	M	S	S	M	S	M	S	L	M
CO4	M	M	S	S	M	M	M	M	S	M	M
CO5	S	M	S	S	S	M	M	M	M	L	M
CO6	M	M	S	S	S	M	M	S	S	L	M

Title of the course : **SOFTWARE ENGINEERING**
Course code : **C-12**
Nature of the course : **Major**
Total credits : **04**
Distribution of Marks : **60TH(End Sem)+ 40 TH (In-Sem)**

COURSEOBJECTIVES:

- To learn and understand the Concepts of Software Engineering.
- To learn and understand Software Development Life Cycle.
- To apply the project management and analysis principles to software project development.
- To apply the design & testing principles to software project development.

UNITS	CONTENTS	L	T	P	Total Hours
1 (12 Marks)	**Introduction**: Evolution, Software Development projects, Emergence of Software Engineering. Software Life cycle models: Waterfall model, Rapid Application Development, Agile Model, Spiral Model	11	01	00	12
2 (12 Marks)	**Requirement Analysis and Specification**: Gathering and Analysis, SRS, Formal System Specification	11	01	00	12
3 (12 Marks)	**Software Design**: Overview, Characteristics, Cohesion & Coupling, Layered design, Function Oriented Design, Structured Analysis, DFD, Structured Design, Detailed design.	11	01	00	12
4 (12 Marks)	**Software design model**: Object Modeling using UML, OO concepts, UML Diagrams, Use case, Class, Interaction, Activity, State Chart, Postscript	11	01	00	12
5 (12 Marks)	**Coding & Testing**: Coding, Review, Documentation, Testing, Black-box, White-box, Integration, Smoke testing.	11	01	00	12
	Total (in Hrs)	55	05	00	60

Where, L:Lectures T: Tutorials P:Practicals

MODESOFIN-SEMESTERASSESSMENT: **(40Marks)**

- Two Internal Examinations **20Marks**
- Others **20Marks**
  - Quiz
  - Seminar presentation
  - Assignment

COURSE OUTCOMES:

After successful completion of this course, learners will be able to

CO1: Explain the fundamental concepts of Software Engineering Lifecycle models.
CO2: Summarize the software requirement specifications and the SRS documents.
CO3: Describe software engineering layered technology and Process frame work.
CO4: Examine the various design and development solutions with proper analysis.
CO5: Demonstrate the competence in communication, planning, analysis, design, construction, and development of software as per the requirements.
CO6: Demonstrate the software project management skills through case studies.

SUGGESTEDREADINGS/ REFERENCES :

1. Rajib Mall, Fundamentals of Software Engineering, PHI 2018, 5th Edition.
2. Roger S. Pressman, Software Engineering - A Practitioner's Approach, McGraw Hill 2010, 7th Edition.
3. Pankaj Jalote, An Integrated Approach to Software Engineering, Narosa Publishing House 2011,3rd Edition.

Title of the course **: SOFTWARE ENGINEERING**
Course code **: C-12**

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	**Remember**	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge						
Conceptual Knowledge		**CO1,CO3**	**CO2**		**CO4**	
Procedural Knowledge		**CO3**		**CO5,CO6**		
Meta cognitive Knowledge					**CO5**	

Mapping of Course Outcomes to Program Outcomes

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	**L**	**M**	**M**	**M**	**S**	**L**	**M**	**S**	**S**	**S**	**S**
CO2	**M**	**M**	**S**	**M**	**S**	**M**	**S**	**M**	**S**	**S**	**S**
CO3	**L**	**M**	**M**	**M**	**M**	**M**	**S**	**S**	**S**	**S**	**S**
CO4	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**S**
CO5	**S**	**S**	**M**	**S**	**M**	**M**	**L**	**L**	**L**	**L**	**S**
CO6	**S**	**S**	**S**	**S**	**S**	**S**	**L**	**M**	**S**	**S**	**M**

Title of the course : **STATISTICAL FOUNDATION OF COMPUTER SCIENCE**
Course code : **C-13**
Nature of the course : **Major**
Total credits : **04**
Distribution of Marks : **60TH(End Sem)+ 40TH(In-Sem)**

COURSE OBJECTIVES:

- To introduce the idea of Data Presentation.
- To explain different Statistical Techniques.
- To describe the concept of Probability and Probability distributions.
- To explain regression and time series.
- To explain Linear programming concepts.

UNITS	CONTENTS	L	T	P	Total Hours
1 (Marks) 12 TH	**Data Presentation:** Diagrammatic representation of data, Frequency distribution, Graphical representation of Frequency Distribution – Histogram, Frequency Polygon, Ogive, Pie-chart etc.	9	3	0	12
2 (Marks) 12 TH	**Basics of Statistical Measures:** Basic idea of Measures of Central Tendencies and Measures of Dispersions, Co-efficient of Variation, Skewness, Kurtosis etc.	9	3	0	12
3 (Marks) 12 TH	**Probability:** Basic Concepts, Basic concepts of Random experiments, trials and events, addition theory, multiplication theory, conditional probability, bayes theorem etc. Probability Distributions. Mathematical Expectation.	9	3	0	12
4 (Marks) 14 TH	**Correlation and Regressions:** Correlation concepts, Scatter diagram, Concept of Covariance, Karl Pearson's Coefficient of Correlation, Spearman's Rank Correlation, Idea of simple linear regression. Use of Regression in Prediction. **Time Series:** Basic ideas, Different components of time series, use and applications of Time series as a data analysis tool	9	3	0	12

5 (Marks) 10 TH	**Linear Programming:** Introduction, Model Formulation, Graphical and Simplex Methods for solving LPP. Transportation Problems.	9	3	0	12
	Total (in Hrs)	45	15	0	60

Where, ***L:Lectures*** ***T: Tutorials*** ***P:Practicals***

MODESOFIN-SEMESTERASSESSMENT: **(40Marks)**

- Two Internal Examinations **20Marks**
- Others **20Marks**
  - Quiz
  - Seminar presentation
  - Assignment

COURSE OUTCOMES:

After the completion of this course, students would be able to

CO1: Explain the basics of statistics.

CO2: Explain the concept of probabilities.

CO3: Explain the use of Regression methods.

CO4: Explain the use of Time Series.

CO5: Explain and use Linear Programming.

SUGGESTEDREADINGS/ REFERENCES:

1. Das N.G, "Statistical Methods*",*Tata McGraw Hill,4th Edition 2012,
2. Gupta, S.P. "Statistical Methods", 5th edition, Chand & Sons publication, 2012.
3. Sharma K.J., " Operation Research: Problems and Solutions",3rdEdition, Macmillan Publishers ,2016.
4. Havinal V. "Introduction to Operations Research", 1st Edition, New Age International Publishers.2012

Title of the course : STATISTICAL FOUNDATION OF COMPUTER SCIENCE
Course code : C-13

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	**Remember**	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge	CO1	CO2				
Conceptual Knowledge	CO1	CO2				
Procedural Knowledge		CO3, CO4	CO3, CO4, CO5			
Metacognitive Knowledge		CO3, CO4, CO5				

Mapping of Course Outcomes to Program Outcomes

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	S	L	M	S	M	M	M	M	L	L	L
CO2	S	L	M	S	M	M	M	M	L	L	L
CO3	S	L	M	S	M	M	M	M	L	L	L
CO4	S	L	M	S	M	M	M	M	L	L	L
CO5	S	L	M	S	M	M	M	M	L	L	L

Title of the Course : COMPILER DESIGN
Course Code : C - 14
Nature of the Course : Major
Total Credits : 04
Distribution of Marks : End Sem: 45 TH + 15 PR, In-Sem:30 TH + 10 PR

COURSE OBJECTIVES:

- To understand various phases in the design of the compiler.
- To introduce different top-down and bottom-up parsers.
- To understand the syntax-directed translation schemes.
- To implement the front end of the compiler.

UNITS	CONTENTS	L	T	P	Total Hours
1 (Marks) 10 TH	**Introduction to Compiler:** The Phases of a Compiler. Compiler-Construction Tools- Lex, YAAC. Symbol Table.	06	01	00	07
2 (Marks) 10 TH + 8 PR	**Lexical Analysis:** Role of Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, Regular Expressions.	10	01	12	23
3 (Marks) 10 TH + 7 PR	**Syntax Analysis:** Need and role of the Parser. Context Free Grammars, Derivation and Parse Tree. Parsing Techniques- Top-down parsing: Recursive - Descent parsing, LL(1) parser. Bottom-up parsing: Shift-Reduce Parser, Operator precedence parser, LR parser, SLR parser, LALR parser, CLR parser.	14	01	8	23
4 (Marks) 5 TH	**Syntax Directed Translation:** Syntax - Directed Definitions, S - Attributed and L - Attributed Definitions, Construction of Syntax Trees, Evaluation of SDT: Bottom-up and Top-down approach. Intermediate code- Three-address code, Quadruples, Triples. Types and Declarations.	10	01	00	11
5 (Marks) 10 TH	**Code Generation:** Issues in design of a Code generator, The Target Language. DAG, Optimization of basic blocks, Machine-dependant and Machine-Independent Optimization.	10	01	00	11
Total (in Hrs)		**50**	**05**	**20**	**75**

where, L: Lectures T: Tutorials P: Practicals

MODES OF IN-SEMESTER ASSESSMENT: (40 Marks)

- One Internal(TH) Examination - **10 Marks**
- One Internal(PR) Examination - **10 Marks**
- Others - **20 Marks**
    - Quiz
    - Seminar presentation
    - Assignment

COURSE OUTCOMES:

After the completion of this course, the learner will be able to:

CO 1: Understand the different phases of a compiler.

CO 2: Apply different parsing algorithms to develop the parsers for a given grammar.

CO 3: Understand syntax-directed translation schemes.

CO 4: Learn code optimization techniques.

CO 5: Implement scanner and parser using LEX and YACC tools.

SUGGESTED READINGS/REFERENCES:

1. Santanu Chattopadhyaya, "Compiler Design", PHI, 2nd Edition, 2022.
2. Srikant, Y.N., & Shankar, P.,"The Compiler Design Handbook: Optimizations and Machine Code Generation", CRC Press., 2nd Edition, 2018.

Title of the Course : COMPILER DESIGN

Course Code : C - 14

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	**Remember**	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge		CO1, CO3, CO4				
Conceptual Knowledge		CO1, CO3, CO4	CO2, CO3	CO3	CO2	
Procedural Knowledge		CO3	CO2, CO3,CO5		CO2	CO5
Metacognitive Knowledge						

Mapping of Course Outcomes to Program Outcomes

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	M	M	M	M	M	M	M	M	M	S	S
CO2	S	S	S	S	S	S	M	S	S	S	S
CO3	M	M	M	S	S	S	M	S	S	S	S
CO4	M	M	M	M	M	S	M	S	S	S	S
CO5	S	M	S	S	S	S	M	S	S	S	S

Title of the course : **DATA COMMUNICATION AND COMPUTER NETWORKS**
Course code : **C-15**
Nature of the course : **Major**
Total credits : **04**
Distribution of Marks : **60TH(End Sem)+ 40TH(In-Sem)**

COURSE OBJECTIVES:

- To understand the basic concepts of data communication and computer networks.
- To understand the working of network layer architecture.
- To learn practical implementation of basic routing algorithms.
- To learn different networking protocols.

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UNITS	CONTENTS	L	T	P	Total Hours
1 (12 Marks)	**Data Communication Fundamentals and Techniques:** Analog and digital signal, data rate limits, digital to digital line encoding schemes, pulse code modulation, digital to analog modulation. **Computer network fundamentals** Introduction to computer networks, types of networks and network topologies. Reference models: The OSI model, TCP/IP protocol suite.	10	01	00	11
2 (12 Marks)	**Physical layer**: Analog transmission and Digital transmissions. Parallel and Serial transmission, Synchronous and Asynchronous transmission, Simplex, Half duplex and Full duplex transmission. Transmission media: Guided and Unguided media. Concept of multiplexing and switching	12	01	00	13
3 (12 Marks)	**Data link layer:** Introduction to Media Access Control Protocols, Internetworking devices, Error control and detection mechanisms.	11	01	00	12
4 (12 Marks)	**Network layer**: Unicast Routing protocols and IP addressing. **Transport layer**: Transmission Control Protocol (TCP) and User Datagram Protocol (UDP).	12	01	00	13
5 (12 Marks)	**Presentation layer**: Concept of data encoding, data compression and data encryption. **Application layer**: WWW, HTTP, FTP, Electronic Mail, TELNET, Secure Cell, DNS, SNMP.	10	01	00	11
	Total (in Hrs)	55	05	00	60

Where, L:Lectures T: Tutorials P:Practicals

MODES OF IN-SEMESTER ASSESSMENT: **(40Marks)**

- Two Internal Examinations **20Marks**
- Others **20Marks**
  - Quiz
  - Seminar presentation
  - Assignment

COURSE OUTCOMES:

After completion of this course, learners will be able to

CO1: Understand the structure of the Data Communications System and its components.

CO2: Explain the layered model approach explained in OSI and TCP/IP network models.

CO3: Identify different types of network topologies and network types.

CO4: Illustrate basic routing mechanisms, IP addressing schemes and internetworking concepts.

CO5: Compare and contrast the major concepts involved in the design of wired and wireless networks.

CO6: Learn basics of network configuration and maintenance.

SUGGESTED READINGS/ REFERENCES:

1. Behrouz A. Forouzan, Data Communications and Networking, Fifth Edition, TMH, 2018.

2. Andrew S. Tanenbaum, David J. Wetherall, Computer Network, Fifth Edition, Pearson Education, 2018.

3. Bhushan Trivedi, Computer Network, Oxford University Press, 2016

4. William Stallings, Data and Computer Communication, PHI, 2017**.**

Title of the course : DATA COMMUNICATION AND COMPUTER NETWORKS
Course code : C-15

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual Knowledge						
Conceptual Knowledge		**CO1,CO3**	**CO2**	**CO2**	**CO4**	
Procedural Knowledge		**CO3**		**CO5,CO6**		
Meta cognitive Knowledge					**CO4**	

Mapping of Course Outcomes to Program Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	**L**	**M**	**M**	**M**	**S**	**L**	**M**	**S**	**S**	**S**	**S**
CO2	**M**	**M**	**S**	**M**	**S**	**M**	**S**	**M**	**S**	**S**	**S**
CO3	**L**	**M**	**M**	**M**	**M**	**M**	**S**	**S**	**S**	**S**	**S**
CO4	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**S**
CO5	**S**	**S**	**M**	**S**	**M**	**M**	**L**	**L**	**L**	**L**	**S**
CO6	**S**	**S**	**S**	**S**	**S**	**S**	**L**	**M**	**S**	**S**	**M**

Title of the course : **WEB APPLICATION DEVELOPMENT WITH DATABASE**
Course code : **Minor-6**
Nature of the course : **Minor**
Total credits : **04**
Distribution of Marks : **End Sem :45 TH + 15 PR, In-Sem: 30 TH + 10 PR**

COURSEOBJECTIVES:

- To introduce the idea of internet and web technologies.
- To explain the different web development tools.
- To discuss different types of databases.
- To explain the process of developing web applications using database.

UNITS	CONTENT	L	T	P	Total Hour
1 (Marks) 10 TH	**Internet and Web Technologies** Basics of internet, Internet protocols, Internet vs Intranet, ISP, URLs, Email, File Transfer Protocol, Internet chatting, Web Servers ,Web Browsers and their functions, Search Engines	07	01	00	08
2 (Marks) 07 TH + 06 PR	**Web Development tools** HTML5, XML, Casacading Style sheets, Scripting Languages: Java Script, ASP, PHP, JHP etc.	09	01	10	20
3 (Marks) 10 TH	**Introduction to Databases** Introduction to Database, Database Advantages, Concept of Database designing, Fields and Data Types, Records, Basic Concept of Normalization.	09	01	00	10
4 (Marks) 08 TH + 05 PR	**Web Databases:** Cocept of Web Servers, My-SQL, Advantages, Working with SQL, Database design in SQL, Exporting and importing data.	09	01	10	20
5 (Marks) 10 TH + 04 PR	**Web Application Development:** Designing Websites using PHP and My SQL, Connecting to the Database by selecting the Database Table, Executing commands and closing the connection to the Database, Working with real time web applications.	06	01	10	17
	Total (in Hrs)	40	05	30	75

Where, ***L: Lectures*** ***T: Tutorials*** ***P: Practicals***

MODES OF IN-SEMESTER ASSESSMENT: (40 Marks)

- One Internal(TH) Examination - **10 Marks**
- One Internal(PR) Examination - **10 Marks**
- Others - **20 Marks**
  - Quiz
  - Seminar presentation
  - Assignment

COURSE OUTCOMES:

After the completion of this course, students would be able to

CO1: Explain different web technologies.

CO2: Use different databases

CO3: Design databases.

CO4: Learn the Connectivity of database to web applications.

CO5: Develop Websites and Web Applications.

SUGGESTED READINGS/REFERENCES:

1. Jain V.K.,"O Level Module - M 1.2 - Internet& Webpage Designing"– BPB Publications,2015
2. Roy U.K., "Web Technologies", Oxford Higher Education, 9th edition 2015.
3. Kumar Akshi, "Web Technology: Theory and Practice", CRC Press", 1st edition-2019
4. Godbole, Khate,"Web Technologies", McGraw Hill Education;,Third edition July 2017

Title of the course : **WEB APPLICATION DEVELOPMENT WITH DATABASE**

Course code : **Minor-6**

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	**Remember**	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge	CO1	CO1, CO4				CO5
Conceptual Knowledge	CO1	CO1, CO4	CO2			CO3, CO5
Procedural Knowledge	CO1	CO1, CO4	CO2			CO3, CO5
Metacognitive Knowledge						CO5

Mapping of Course Outcomes to Program Outcomes

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	M	M	M	S	L	M	L	L	L	L	L
CO2	S	S	S	M	M	M	M	M	M	L	M
CO3	S	S	M	M	M	M	M	M	M	L	M
CO4	L	M	L	L	L	L	L	L	L	L	L
CO5	S	S	M	S	M	M	M	M	M	L	M

Title of the course : **COMPUTER GRAPHICS**
Course code : **C-16**
Nature of the course : **Major**
Total credits :**04**
Distribution of Marks : **60 TH (End Sem) + 40TH (In-Sem)**

COURSE OBJECTIVES:

- To understand the basic principles of graphics algorithm design.
- To familiarize the theoretical background of the different graphics packages, demonstrate functionality of display devices.
- To introduce how graphics hardware and software work in real work applications.
- To familiarize the students with fundamental criteria of an animation.
- To relate projection of an object in real world scenario.
- To apply the idea about basic building blocks of multimedia and a study about how these blocks together with the current technology and tools.

UNITS	CONTENTS	L	T	P	Total Hour
1 (12 Marks)	**Introduction:** Basic elements of Computer graphics, Applications of Computer Graphics	10	01	00	10
2 (12Marks)	**Display Devices :** Different display devices, Video Controller, Digital frame buffer, Plasma panel displays, Liquid Crystal Display (LCD), Color-display techniques (Shadow mask and penetration CRT),	12	01	00	10
3 (12 Marks)	**Output primitives:** Points and lines, line drawing algorithms, circle and ellipse generating algorithms	12	01	00	10
4 (12 Marks)	**Geometrical transformations :** Basic transformations, translations, rotation and scaling, viewing Clipping Operations: Point clipping, line clipping, Text clipping.	11	01	00	10
5 (12 Marks)	**Animation and Multimedia :** Introduction to computer animation and virtual reality Introduction to multimedia and its components, Basic concept of Image, Different multimedia components and file formats, Animation components, morphing and application, Graphics tools, image editing tools.	10	01	00	10
	Total (in Hrs)	55	05	00	60

Where, L:Lectures T: Tutorials P:Practicals

MODESOFIN-SEMESTERASSESSMENT:(40Marks)

- Two Internal Examinations **20 Marks**
- Others **20 Marks**
    - o Quiz
    - o Seminar presentation
    - o Assignment

COURSE OUTCOMES:

After successful completion of this course, students would be able to

CO1: Apply output primitives algorithm to create graphics.

CO2: Acquire familiarity with the concepts and relevant mathematics of computer graphics.

CO3: Implement various algorithms to scan, convert the basic geometrical primitives, transformations, area filling, clipping.

CO4: Describe the importance of viewing and projections.

CO5: Illustrate basic graphics application programs.

CO6: Design applications that display graphic images to given specifications.

CO7: Learn how graphics functions work.

SUGGESTED READINGS/REFERENCES:

1. D, Hearn,; and M.P. Baker,"Computer Graphics" , PHI 2/e, 2019.
2. A. P., Godse. "Computer Graphics And Multimedia (English)", Technical Publication ,1st Edition ,2019.
3. K, Pakhira. "Computer Graphics Multimedia & Animation"2nd edition,Phi Learning Pvt. ltd
4. D.P., Mukherjee. "Fundamentals Of Computer Graphics And Multimedia" Phi Learning, 1st Edition .

Title of the course : COMPUTER GRAPHICS

Course code : C-16

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual Knowledge	CO2	CO7			CO2	
Conceptual Knowledge		CO2	CO1	CO3	CO6	
Procedural Knowledge	CO4	CO4	CO5	CO5	CO1	CO3
Metacognitive Knowledge			C01	CO4		CO6

Mapping of Course Outcomes to Program Outcomes

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M	M	M	S	S	S	S	S	M	M	M
CO2	M	M	S	S	S	M	M	M	M	M	S
CO3	S	S	M	M	M	S	S	S	M	S	S
CO4	S	M	S	S	S	M	M	M	S	M	S
CO5	S	M	M	S	S	S	S	M	M	M	M
CO6	S	S	M	M	S	S	M	M	M	S	S
CO7	S	M	M	M	S	S	S	S	S	S	M

Title of the course : **MACHINE LEARNING**
Course code : **C-17**
Nature of the course : **Major**
Total credits :**04**
Distribution of Marks : **60TH (End Sem)+ 40TH(In-Sem)**

COURSE OBJECTIVES:

- To introduce the fundamental concepts of machine learning and its applications
- To learn the classification, clustering and regression-based machine learning algorithms
- To understand the methods of solving real life problems using the machine learning techniques

UNITS	CONTENTS	L	T	P	Total Hours
1 (5 Marks)	**Introduction** Basic concept, Supervised Learning, Unsupervised learning, Reinforcement learning, Parametric and non-parametric methods.	05	00	00	5
2 (15 Marks)	**Supervised Learning: Regression** Linear regression, Variable selection, Regularization, Ridge regression, Lasso, Elastic net, Regression Trees, Bagging, Boosting, Random forests, Support vector machines, Cross-validation, Bootstrapping, Principal Components Regression, Partial Least Squares Regression, Basis functions, Splines, Generalized Additive Models.	15	02	00	17
3 (15 Marks)	**Supervised Learning** Classification Bayes classifier, k nearest neighbours, Logistic regression, Linear discriminant analysis, Quadratic discriminant analysis, Perceptron, Artificial neural networks.	12	01	00	13
4 (10 Marks)	**Unsupervised Learning** Clustering, K-means clustering, Hierarchical clustering, Dimensionality reduction, Multidimensional scaling, Principal component analysis, Kernel methods.	12	01	00	13
5 (15 Marks)	**Deep Learning Architectures and Applications** Convolution neural network (CNN) -Layers in CNN -CNN architectures. Recurrent Neural Network -Applications: Speech-to-text conversion-image classification-time series prediction.	11	01	00	12
	Total (in Hrs)	**55**	**05**	**00**	**60**

Where, L:Lectures T: Tutorials P:Practicals

MODES OF IN-SEMESTER ASSESSMENT: **(40Marks)**

- Two Internal Examinations **20Marks**
- Others **20Marks**
  - Quiz
  - Seminar presentation
  - Assignment

COURSE OUTCOMES:

After successful completion of this course, students would be able to

CO1: Understand the basic concepts of Machine Learning.

CO2: Compare different classification algorithms used in machine learning.

CO3: Understand clustering and component analysis techniques

CO4: Design deep learning architectures for solving real life problems

SUGGESTED READINGS/REFERENCES:

1. Carbonell, Jaime G., Ryszard S. Michalski, and Tom M. Mitchell. "An overview of machine learning." Machine learning (1983): 3-23.
2. Alpaydin, Ethem. Introduction to machine learning. MIT press, 2020.
3. Murphy, Kevin P. Machine learning: a probabilistic perspective. MIT press, 2012.
4. Wlodarczak, Peter. Machine learning and its applications. CRC Press, 2019.

Title of the course **: MACHINE LEARNING**
Course code **: C-17**

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	**Remember**	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge						
Conceptual Knowledge	**CO1**	**CO1,CO3**	**CO2**		**CO2**	
Procedural Knowledge		**CO3**		**CO2**		
Metacognitive Knowledge						**CO4**

Mapping of Course Outcomes to Program Outcomes

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	**L**	**M**	**M**	**M**	**S**	**L**	**M**	**S**	**S**	**S**	**S**
CO2	**M**	**M**	**S**	**M**	**S**	**M**	**S**	**M**	**S**	**S**	**S**
CO3	**L**	**M**	**M**	**M**	**M**	**M**	**S**	**S**	**S**	**S**	**S**
CO4	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**S**

Title of the course : **WEB TECHNOLOGY**
Course code : **C-18**
Nature of the course : **Major**
Total credits : **04**
Distribution of Marks : **End Sem: 45 TH + 15 PR, In-Sem: 30 TH + 10 PR**

COURSE OBJECTIVES:

- To describe the fundamental ideas behind web technology.
- To use JavaScript, HTML, and CSS for web development.
- To examine frameworks and ideas of responsive design.
- To describe the fundamentals of databases and server-side scripting.
- To design web apps.

UNITS	CONTENTS	L	T	P	Total Hours
1 (Marks) 06 TH	**Introduction to Web Technologies:** Overview of the Internet and the World Wide Web Introduction to HTML, CSS, and JavaScript Web browsers and developer tools**.**	07	01	00	08
2 (Marks) 12 TH + 04 PR	**Fundamentals of HTML, CSS:** Structure of HTML documents, Text formatting and hyperlinks, Lists, tables, forms, and multimedia. CSS syntax and selectors, Styling text, colors, backgrounds, and borders, Layout techniques: Flexbox and Grid.	09	01	08	18
3 (Marks) 12 TH + 05 PR	**Basics of JavaScript and Document Object Model (DOM):** JavaScript syntax and variables, Control structures: loops and conditionals, Functions and objects Manipulating HTML and CSS using JavaScript, Event handling and listeners, DOM traversal and manipulation.	09	01	08	18
4 (Marks) 05 TH + 02 PR	**Responsive Web Design:** Media queries and viewport meta tag, Fluid layouts and flexible grids, Responsive images and Typography	06	01	05	12
5 (Marks) 10 TH + 04 PR	**Introduction to Server-Side Development and Web Development Frameworks:** Basics of server-side scripting languages (e.g., PHP, Node.js), Introduction to databases and SQL, Building dynamic web applications, Overview of popular web development frameworks (e.g., React, Angular, Vue.js)	09	01	09	19
	Total (in Hrs)	**40**	**05**	**30**	**75**

where, ***L:Lectures*** ***T: Tutorials*** ***P:Practicals***

MODES OF IN-SEMESTER ASSESSMENT: (40 Marks)

- One Internal(Theory) Examination- **10 Marks**
- One Internal(Theory) Examination- **10 Marks**
- Others(Anyone) - **20 Marks**
    - Quiz
    - Seminar presentation
    - Assignment

COURSE OUTCOMES:

After the completion of this course, the learner will be able to:

CO1: Explain web technology.

CO2: Apply the knowledge of JavaScript, HTML, and CSS for web development.

CO3: Use databases and server-side scripting in web development projects.

CO4: Design responsive web applications.

SUGGESTED READINGS/REFERENCES:

1. Jon Duckett, "HTML and CSS: Design and Build Websites", 2011
2. Jon Duckett, "JavaScript and JQuery: Interactive Front-End Web Development", 2014.
3. Online tutorials and documentation (e.g., MDN Web Docs, W3Schools)
4. Web development forums and communities (e.g., Stack Overflow, GitHub)

Title of the course **: WEB TECHNOLOGY**
Course code **: C-18**

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	**Remember**	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge		**CO1**		**CO1**		
Conceptual Knowledge		**CO1**		**CO1**		
Procedural Knowledge			**CO2, CO3**			**CO4**
Meta cognitive Knowledge			**CO2, CO3**			**CO4**

Mapping of Course Outcomes to Program Outcomes

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	**M**	**M**	**L**	**M**	**L**	**L**	**L**	**M**	**L**	**S**	**M**
CO2	**S**	**S**	**M**	**M**	**L**	**L**	**L**	**S**	**L**	**S**	**S**
CO3	**S**	**S**	**M**	**M**	**L**	**M**	**L**	**S**	**M**	**S**	**S**
CO4	**S**	**S**	**M**	**M**	**L**	**M**	**L**	**S**	**M**	**S**	**S**

Title of the course : **WIRELESS COMMUNICATION NETWORKS**
Course code : **C-18**
Nature of the course : **Major**
Total credits : **04**
Distribution of Marks : **60TH (End-Sem)+ 40TH(In-Sem)**

COURSE OBJECTIVES:

- To understand the functions of wireless communication network and the standards.
- To learn the technologies used in wireless communication.
- To understand the architecture and protocols used in wireless communication network.
- To learn security issues associated with wireless network.

UNITS	CONTENTS	L	T	P	Total Hour
1 (12 Marks)	**Overview of wireless communication**: Cellular communication, different generations and standards in cellular communication system, satellite communication including GPS, wireless local loop, cordless phone, paging systems, RFID.	10	01	00	11
2 (12 Marks)	**Recent wireless technologies**: Multicarrier modulation, OFDM, MIMO system, diversity-multiplexing trade-off, smart-antenna; cognitive radio, communication relays, spectrum sharing.	10	01	00	11
3 (12 Marks)	**Multiple access techniques in wireless communication**: Contention-free multiple access schemes, contention-based multiple access schemes.	11	01	00	12
4 (12 Marks)	**Wireless Networks**: Wireless personal area networks (Bluetooth, UWB and ZigBee), wireless local area networks, wireless metropolitan area networks (WiMAX).	10	01	00	11
5 (12 Marks)	**Ad-hoc wireless networks**: Design Challenges in Ad-hoc wireless networks, concept of cross layer design, security in wireless networks, energy constrained networks. MANET and WSN. **Wireless system protocols** : Mobile network layer protocol (mobile IP, IPv6, dynamic host configuration protocol), mobile transport layer protocol (traditional TCP, classical TCP improvements), support for mobility (wireless application protocol).	14	01	00	15
	Total (in Hrs)	55	05	00	60

Where, L: Lecturess T: Tutorials P: Practicals

MODESOFIN-SEMESTERASSESSMENT: **(40Marks)**

- Two Internal Examinations **20Marks**
- Others **20Marks**
  - Quiz
  - Seminar presentation
  - Assignment

COURSE OUTCOMES:

After the completion of this course, the learner will be able to

CO1: Describe the functioning of wireless communication network.
CO2: Compare and contrast the technologies used in wireless communication Network.
CO3: Explain the architecture, protocols and applications of wireless communication network.
CO4: Evaluate design challenges, constraints and security issues associated with Ad-hoc wireless networks.
CO5: Analyze the wireless installation and deployment techniques in real-world networks.

SUGGESTEDREADINGS:

1. Theodore S Rappaport, Wireless Communications, Principles and Practice, Pearson Education Asia, 2nd edition, 2009, ISBN: 9780133755367.
2. Vijay K.Garg, Wireless Communications and Networking, Morgan Kaufmann Publishers, Indian Reprint, 2009,ISBN: 978-81-312-1889-1.
3. William Stallings, Wireless Communications and Networks, Pearson Education Asia, 2nd edition, 2005, ISBN 13: 9780131918351.
4. Sassan Ahmadi, LTE-Advanced – A practical systems approach to understanding the 3GPP LTE Releases 10 and 11 radio access technologies, Elsevier, 2014

Title of the course : WIRELESS COMMUNICATION NETWORKS

Course code : C-18

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual Knowledge						
Conceptual Knowledge		**CO1,CO2**	**CO2**	**CO2**	**CO4**	
Procedural Knowledge			**CO3**	**CO5**		
Meta cognitive Knowledge					**CO5**	

Mapping of Course Outcomes to Program Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	**L**	**M**	**M**	**M**	**S**	**L**	**M**	**S**	**S**	**S**	**S**
CO2	**M**	**M**	**S**	**M**	**S**	**M**	**S**	**M**	**S**	**S**	**S**
CO3	**L**	**M**	**M**	**M**	**M**	**M**	**S**	**S**	**S**	**S**	**S**
CO4	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**S**
CO5	**S**	**S**	**M**	**S**	**M**	**M**	**L**	**L**	**L**	**L**	**S**

Title of the Course : INTERNET OF THINGS
Course Code : C-18
Nature of the Course : Major
Total Credits : 04
Distribution of Marks : 60 TH (End Sem)+40TH (In-Sem)

COURSE OBJECTIVES:

- To explain the fundamental concepts of IoT
- To describe the hardware components used in IoT.
- To discuss the different technologies used in IoT
- To explain the role of IoT in various domains of Industry.

UNIT	CONTENTS	L	T	P	Total Hours
1 (15Marks)	**Introduction to the Internet of Things (IoT):** Definitions & Characteristics of IoT, IoT Architectures, Physical & Logical Design of IoT, Enabling Technologies in IoT, History of IoT, The Identifiers in IoT, IoT frameworks, IoT and M2M.	12	3	-	15
2 (15Marks)	**Hardware Components and Sensor Networks:** Sensors, Types of Sensors, actuators, Types of Actuators, Microcontrollers and microprocessor, IoT Development Boards: Arduino IDE and Board Types, RaspberriPi Development Kit, RFID Principles and components, Wireless Sensor Networks: History and Context, The node, Connecting nodes, Networking Nodes, WSN and IoT.	12	3	-	15
3 (15Marks)	**Wireless Technologies for IoT:** WPAN Technologies for IoT: IEEE 802.15.4, Zigbee, HART, NFC, Z-Wave, BLE, Bacnet, Modbus. IP Based Protocols for IoT IPv6, 6LowPAN, RPL, REST, AMPQ, CoAP, MQTT. Edge connectivity and protocols.	12	3	-	15
4 (15Marks)	**Applications of IoT**: Home Automation, Smart Cities, Energy, Retail Management, Logistics, Agriculture, Health and Lifestyle, Industrial IoT, Legal challenges, IoT design Ethics, IoT in Environmental Protection.	12	3	-	15
	Total (in Hrs)	**48**	**12**	**-**	**60**

Where, L: Lectures T: Tutorials P: Practicals

MODES OF IN-SEMESTER ASSESSMENT: (40 Marks)

- Two Internal Examination - **20 Marks**
- Others - **20 Marks**
    - o Quiz
    - o Seminar presentation
    - o Assignment

COURSE OUTCOMES:

After the completion of this course, the learner will be able to

CO1. Understand the various concepts and terminologies of IoT systems

CO2. Explain the basic architecture of an IoT system.

CO3. Describe different hardware and development kits used in the design of IoT.

CO4. Understand various protocols for the design of IoT systems.

CO5. Explain the use of various applications of IoT

SUGGESTED READINGS/ REFERENCES:

1. Hakima Chaouchi, — "The Internet of Things Connecting Objects to the Web" ISBN : 978-1- 84821-140-7, Wiley Publications
2. Olivier Hersent, David Boswarthick, and Omar Elloumi, — "The Internet of Things: Key Applications and Protocols", WileyPublications
3. Vijay Madisetti and ArshdeepBahga, — "Internet of Things (A Hands-on-Approach)", 1st 2Edition, VPT, 2014.
4. J. Biron and J. Follett, "Foundational Elements of an IoT Solution", O'Reilly Media, 2016.

Title of the Course : INTERNET OF THINGS
Course Code : C-18

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	**Remember**	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge	CO1	CO1, CO3				
Conceptual Knowledge	CO1	CO1, CO2, CO3, CO4, CO5				
Procedural Knowledge						
Metacognitive Knowledge						

Mapping of Course Outcomes to Program Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M	L	M	M	L	L	S	L	L	L	S
CO2	M	L	M	M	L	L	S	M	M	L	S
CO3	S	L	M	M	M	L	S	M	M	L	S
CO4	M	L	M	M	M	L	S	L	L	L	S
CO5	M	L	M	M	M	L	S	M	M	L	S

Title of the Course	**:**	**PROGRAMMING IN PYTHON**
Course Code	**:**	**Minor-7**
Nature of the Course	**:**	**Minor**
Total Credits	**:**	**04**
Distribution of Marks	**:**	**End Sem : 45 TH + 15 PR, In-Sem: 30 TH + 10 PR**

COURSE OBJECTIVES:

- Learn the basics of programming language.
- Develop, document, and debug modular Python programs.
- Apply suitable programming constructs and built-in data structures to solve a problem.
- Use and apply various data objects in Python.
- Use classes and objects in application programs and handle.

UNITS	CONTENTS	L	T	P	Total Hours
1 (Marks) 5 TH + 2 PR	**Introduction to Programming:** Problem solving strategies; Structure of a Python program; Syntax and semantics; Executing simple programs in Python.	05	01	02	08
2 (Marks) 10 TH + 4 PR	**Creating Python Programs:** Identifiers and keywords; Literals, numbers, and strings; Operators; Expressions; Input/output statements; Defining functions; Control structures (conditional statements, loop control statements, break, continue and pass, exit function), default arguments.	10	01	08	19
3 (Marks) 10 TH + 4 PR	**Built-in data structures:** Mutable and immutable objects; Strings, built-in functions for string, string traversal, string operators and operations; Lists creation, traversal, slicing and splitting operations, passing list to a function; Tuples, sets, dictionaries and their operations.	10	01	08	19
4 (Marks) 10 TH + 2 PR	**Object Oriented Programming:** Introduction to classes, objects and methods; Standard libraries.	07	01	06	14
5 (Marks) 10 TH +3 PR	**File and exception handling:** File handling through libraries; Errors and exception handling.	08	01	06	15
	Total (in Hrs)	**40**	**05**	**30**	**75**

Where, L: Lectures T: Tutorials P: Practicals

MODES OF IN-SEMESTER ASSESSMENT: **(40 Marks)**

- One Internal(TH) Examination - **10 Marks**
- One Internal(PR) Examination - **10 Marks**
- Others - **20 Marks**
    - Quiz
    - Seminar presentation
    - Assignment

COURSE OUTCOMES:

After the completion of this course, the learner will be able to:

CO1: plain the structure and basic components of a Python program, including syntax, operations, and standard data types.
CO2: Apply Python to develop scripts involving basic input/output operations, use of control structures like loops and conditional statements, and handling basic file operations.
CO3 Differentiate between mutable and immutable data types and analyze the use of built-in Python structures like lists, tuples, dictionaries, and sets in various programming scenarios.
CO4: Calculate Python codefor efficiency and readability, and select appropriate error and exception handling techniques to enhance program robustness and reliability.
CO5: Design and implement a Pythonprogram that integrates object-oriented programming concepts and employs complex data structures and functions to solve real-world problems.

SUGGESTED READINGS/REFERENCES:

1. Taneja, S., Kumar, N. “Python Programming- A modular Approach”, 1st edition, Pearson Education India, 2018.Dr. Anita Goel, Computer Fundamentals, Pearson Education, 2019.
2. T. Budd, Exploring Python, TMH, 1st Ed, 2019.
3. A. B. Downey, Think Python, 2e: How to Think Like a Computer Scientist, O′Reilly, 2015.
4. C. Morris, “https://www.kaggle.com/learn/python,” [Online].
5. “https://docs.python.org/3/tutorial/index.html,” [Online].

Title of the Course : **PROGRAMMING IN PYTHON**

Course Code : **Minor-7**

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual Knowledge	CO1					
Conceptual Knowledge	CO2	CO1	CO2, CO5	CO2, CO3	CO4	CO2, CO5
Procedural Knowledge		CO1	CO2, CO5	CO5, CO2, CO3	CO4	CO2, CO5
Metacognitive Knowledge		CO1	CO2, CO5	CO3	CO5	CO5

Mapping of Course Outcomes to Program Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	S	S	S	S	S	S	S	S	M	L	S
CO2	S	S	S	S	S	S	S	S	S	L	M
CO3	S	S	S	S	S	S	M	S	M	L	M
CO4	S	S	S	S	S	S	M	S	M	L	M
CO5	S	S	S	S	S	S	M	S	M	L	M

Title of the course : **R PROGRAMMING**
Course code : **Minor-7**
Nature of the course : **Minor**
Total credits : **04**
Distribution of Marks : **End Sem :45 TH + 15 PR, In-Sem: 30 TH + 10 PR**

COURSE OBJECTIVES:

- To introduce the idea of R Programming
- To explain the features of R Programming
- To explain basic Statistical Computation Techniques
- To explore data analysis in R

UNITS	CONTENTS	L	T	P	Total Hours
1 (Marks) 08 TH	**Basics of R Programming:** Features and Advantages of R Programming, Installation and use. Detail Idea about the interface of R . Features and Advantages of R , Advantages of R Programming in Data Analysis.	07	01	00	08
2 (Marks) 10 TH + 04 PR	**Working with R Programming:** Introduction to R and RStudio, Data Import and Export: Importing data from other files like text and csv files. Exporting R data to other formats. Advantages of data import and export in practical situations.	09	01	05	15
3 (Marks) 08 TH + 04 PR	**Basics of Statistical Computing:** Concept of Measures of Central tendencies and dispersions, Basics of Probabilities and Probability distribution, Correlation and Regression. Idea of Time Series, Popular Predictive and Classification techniques.	09	01	10	20
4 (Marks) 09 TH + 03 PR	**Programming in R and R Packages:** Calculations in R, Inbuilt functions in R, Basic Object Types and Operations in R.Idea of Scalar and Vectors, creating loops and nested statements using R programming	09	01	10	20
5 (Marks) 10 TH + 04 PR	**Data Analysis in R Studio** Use of packages and library, installing packages, calling packages for data analysis, implementation statistical techniques in R programming and R studio with Real life problem.	06	01	05	12
	Total (in Hrs)	40	05	30	75

Where, L:Lectures T: Tutorials P:Practicals

MODES OF IN-SEMESTER ASSESSMENT: (40 Marks)

- One Internal(TH) Examination - **10 Marks**
- One Internal(PR) Examination - **10 Marks**
- Others - **20 Marks**
  - Quiz
  - Seminar presentation
  - Assignment

COURSE OUTCOMES:

After the completion of this course, students would be able to

CO1: understand the features and advantages of R programming.

CO2: explain different data analysis techniques.

CO3: use R Programming in real life problems.

CO4: use different packages using R Studio.

CO5: complete Data Analytics project in R studio.

SUGGESTEDREADINGS/ REFERENCES:

1. Scott V. Burger, "Introduction to Machine Learning with R", O'REILLY, First Edition,March 2018
2. Norman Matloff, "The Art of R programming" No starch press (San Francisco),First Edition.
3. Das N.G, "Statistical Methods", Tata McGraw Hill ,4th Edition 2012,
4. Grolemund, "Hands on programming with R" Shroff O'reilly, First Edition 2014

Title of the course : R PROGRAMMING

Course code : Minor-7

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	**Remember**	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge	CO1, CO2	CO1, CO2				CO3
Conceptual Knowledge	CO1, CO2	CO1, CO2	CO3, CO4	CO5		CO3, CO5
Procedural Knowledge	CO1, CO2	CO1, CO2	CO3, CO4	CO5		CO3, CO5
Metacognitive Knowledge	CO1, CO2					

Mapping of Course Outcomes to Program Outcomes

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	L	L	M	M	M	M	L	L	L	L	L
CO2	L	L	M	M	M	M	L	L	L	L	L
CO3	M	M	M	S	M	M	M	M	M	L	M
CO4	M	M	M	S	M	L	M	M	M	L	M
CO5	M	M	M	S	M	M	M	M	M	L	M

Title of the Course **: MATLAB PROGRAMMING**

Course Code **: Minor- 7**

Nature of the Course **: Minor**

Total Credits **: 04**

Distribution of Marks **:End Sem: 45 TH +15 PR, In Sem: 30 TH+ 10PR**

COURSEOBJECTIVES:

- Familiarize students with the MATLAB environment.
- Introduce various data types and operators supported in MATLAB
- Introduce basic MATLAB functions and commands.
- Help to understand the advantages of using MATLAB for numerical computation, data analysis.
- Discuss how to create matrices in MATLAB, explore different methods of matrix formation

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UNITS	CONTENTS	L	T	P	Total Hour
1 (Marks) 5 TH	Introduction to MATLAB , Brief History of MATLAB, The Advantages of MATLAB, Disadvantages of MATLAB, The MATLAB Environment, Features of MATLAB, Uses of MATLAB, Installation of MATLAB, Basic Functions of MATLAB, Mostly used symbols in MATLAB.	06	01	-	07
2 (Marks) 10TH	MATLAB Data Types, Command Handling, Operator and Special Characters, Common Mathematical Functions, Relational and Logical operators, Variables, Character and Strings, Concatenation of strings.	07	01	-	8
3 (Marks) 10TH+5 PR	Scalar and vector, Elementary featured in vector array, Matrix Formation, Matrix Sum, transpose and random function, Accessing Matrix element, Useful Matrix Commands, Eigen values and Eigen vectors, Matrix operation, Matrix operators, Indexing Array Value, Mathematical operation on Array, Array Types.	09	01	10	20
4 (Marks) 10TH+5PR	Input and output function, max and Min Function, Matlab String Handling, Saving and loading Variables, Opening and Closing Files, Two Dimensional Plots Parametric plot, Contour Plots and Implicit Plots, Setting Colours to Graph.	09	01	10	20
5 (Marks) 10 TH+5PR	Operating MatLab Editor, Editor Toolbar, Creating and Running Script File, Functions- Function M Files, Function, Parts of Function M Files, Workspace, Function Types.	09	01	10	20
	Total(in Hrs)	**40**	**05**	**30**	**75**

where, ***L:Lectures*** ***T: Tutorials*** ***P: Practicals***

MODES OF IN-SEMESTER ASSESSMENT: **(40Marks)**

- One Internal (TH) Examination **10 Marks**
- One Internal(PR) Examination **10 Marks**
- Others 2**0 Marks**
    - Quiz
    - Seminar presentation
    - Assignment

COURSE OUTCOMES:

After the completion of this course, the learner will be able to:

CO1: Create, manipulate, and analyze vector arrays in MATLAB.

CO2: Use MATLAB's input and output functions.

CO3: Understand a range of useful MATLAB commands of matrix.

CO4: Gain proficiency in creating and customizing two-dimensional plots in MATLAB.

CO5: Create MATLAB script files to write and execute sequences of MATLAB commands.

SUGGESTED READINGS/REFERENCES:

1. Gilat A, "MATLAB An Introduction with Applications", Wiley Publication,2012.
2. Chapman S.J.,"MATLAB Programming for Engineers",Cengage, 4th edition 2012.
3. Bansal R.K., Goel A.K., "MATLAB and its Applications in Engineering",Laxmi Publications, 2016.
4. Pratap R., "MATLAB 7", Oxford University Press, Oxford University Press, 2005.

Title of the Course : **MATLAB PROGRAMMING**

Course Code : **Minor- 7**

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual Knowledge		CO1				
Conceptual Knowledge			CO2	CO1		CO1
Procedural Knowledge		CO3			CO5	CO4
Metacognitive Knowledge	CO4					CO5

Mapping of Course Outcomes to Program Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	S	S	S	S	S	M	S	S	S	M	S
CO2	S	S	S	S	S	M	S	S	S	S	S
CO3	S	S	S	S	S	M	S	S	S	M	S
CO4	S	S	S	S	S	M	S	S	S	M	S
CO5	S	S	S	S	S	M	S	S	S	M	S

Title of the course : **INFORMATION AND NETWORK SECURITY**
Course code : **C-19**
Nature of the course : **Major**
Total credits : **04**
Distribution of Marks : **60TH(End Sem)+ 40TH(In-Sem)**

COURSE OBJECTIVES:

- To understand the basics of Cryptography and Network Security.
- To learn about how to maintain the Confidentiality, Integrity and Availability of data.
- To understand various protocols for network security to protect against the threats in the networks.

UNITS	CONTENT	L	T	P	Total Hours
1 (12 Marks)	**Introduction**: Security Trends, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms.	07	01	00	08
2 (12 Marks)	**Classical Encryption Techniques**: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Block Cipher Principles, The Data Encryption Standard. **Public-Key Cryptography and RSA**: Principles of Public-Key Cryptosystems, The RSA Algorithm.	12	01	00	13
3 (12 Marks)	**Message Authentication and Hash Functions**: Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Functions. **Digital Signatures and Authentication**: Digital Signatures, Authentication Protocols, Digital Signature Standard.	12	01	00	13
4 (12 Marks)	**Electronic Mail Security**: Pretty Good Privacy, S/MIME. **IP Security**: Overview, Architecture, Authentication Header, Encapsulating Security Payload, Key Management. **Web Security**: Web Security Considerations, Secure Socket Layer and Transport Layer Security, Secure Electronic Transaction.	12	01	00	13
5 (12 Marks)	**Intrusion**: Intruders, Intrusion Techniques, Intrusion Detection **Malicious Software**: Viruses and Related Threats, Virus Countermeasures,	12	01	00	13

	DDOS **Firewalls**: Firewall Design Principles, Types of Firewalls				
	Total (in Hrs)	55	05	00	60

Where, L:Lectures T: Tutorials P:Practicals

MODESOFIN-SEMESTERASSESSMENT: (40Marks)

- Two Internal Examinations - **20Marks**
- Others - **20Marks**
  - Quiz
  - Seminar presentation
  - Assignment

COURSE OUTCOMES:

After successful completion of this course, learners will be able to

CO1: Understand the principles and practices of cryptographic techniques.

CO2: Understand a variety of generic security threats and vulnerabilities.

CO3: Identify particular security problems for a given application.

CO4: Analyze security problems of a given application.

CO5: Understand various protocols for network security to protect against the threats in a network

SUGGESTEDREADINGS:

1. William Stallings, Cryptography And Network Security, Principles And Practice, 6th Edition, Pearson,2016.
2. Mark Stamp, Information Security Principles and Practice, Willy India Edition,2011.
3. Forouzan and Mukhopadhyay, Cryptography & Network Security, McGrawHill,2008.
4. Atul Kahate, Cryptography and Network Security, TMH,2019.

Title of the course : INFORMATION AND NETWORK SECURITY

Course code : C-19

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual Knowledge						
Conceptual Knowledge		**CO1,CO2**	**CO2**	**CO2**	**CO4**	
Procedural Knowledge			**CO3**	**CO5**		
Meta cognitive Knowledge					**CO5**	

Mapping of Course Outcomes to Program Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	**L**	**M**	**M**	**M**	**S**	**L**	**M**	**S**	**S**	**S**	**S**
CO2	**M**	**M**	**S**	**M**	**S**	**M**	**S**	**M**	**S**	**S**	**S**
CO3	**L**	**M**	**M**	**M**	**M**	**M**	**S**	**S**	**S**	**S**	**S**
CO4	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**S**
CO5	**S**	**S**	**M**	**S**	**M**	**M**	**L**	**L**	**L**	**L**	**S**

Title of the course : **EMBEDDED SYSTEM**
Course code : **C-19**
Nature of the course : **Major**
Total credits : **04**
Distribution of Marks : **60TH (End Sem) + 40 TH(In-Sem)**

COURSE OBJECTIVES:

- To introduce with the fundamental concepts of embedded system, features, and requirements.
- To explain embedded system design paradigms and architectures.
- To explain about the hardware and software of embedded systems.
- To introduce with the basic concepts of microcontroller and microprocessor.

UNITS	CONTENTS	L	T	P	Total Hours
1 (12Marks)	**Introduction to Embedded system:** Embedded system and general-purpose computer systems, History, Classifications, Applications, and Purpose of Embedded Systems.	09	03	-	12
2 (12Marks)	**Characteristics and quality attributes of embedded systems:** Characteristics, Operational and nonoperational quality attributes, Domain specific – automotive, Application Specific Embedded System	09	03	-	12
3 (12Marks)	**Embedded hardware:** Memory map, I/O map, Interrupt map, Processor family, External peripherals, Memory - RAM, ROM, Type of RAM and ROM, Memory testing, CRC, Flash memory.	09	03	-	12
4 (12Marks)	**Embedded Software:** Hardware and software in Embedded system – Memory organizations, Device driver – interrupt handling unit, Concept of embedded software engineering – RTOS (Real Time Operating System), Popular RTOS and their applications, Basics of serial communication	09	03	-	12
5 (12Marks)	**Embedded controllers:** Basic differences of microcontroller and microprocessor – Microcontroller and embedded processor, Concept on different controllers like 8051, PIC,Architecture of 8051, Pin configuration, Registers, Interrupts, RAM allocation	09	03	-	12
	Total (in Hrs)	45	15	00	60

Where, L:Lectures T: Tutorials P:Practicals

MODESOFIN-SEMESTERASSESSMENT: **(40Marks)**

- Two Internal Examination - **20Marks**
- Others(Anyone) - **20Marks**
  - Quiz
  - Seminar presentation
  - Assignment

COURSE OUTCOMES:

After successful completion of this course, the learner will be able to

CO1: Learn the basic concepts, structure, and applications of microprocessors.

CO2: Learn the basic concepts, structure, and applications of microcontrollers.

CO3: Describe basic functions, structure, and applications of embedded system.

CO4: Compare general purpose computers with embedded systems.

CO5: Explain the hardware and software in embedded system.

CO6: Understand the concept of different embedded controllers.

SUGGESTEDREADINGS/REFERENCES:

1. Kamal.R.," Embedded systems: architecture, programming and design", Tata Mc Graw Hill Publications, 3rdEdition, 2017.
2. Hamacher.C.,Vranestic Z.,Zaky S.,Manjikian N. "Computer Organization& Embedded Systems", McGraw- Hill International 6thEdition,2023.
3. Ram.B., "Fundamentals of Microprocessors and Microcomputers", 5th edition, Dhanpat Rai Publications, 2018.
4. Furber.S.," Arm System-on-chip architecture", Pearson, Second Edition, 2013.
5. Godse A P., Godse D., "Microprocessors & Microcontrollers, Technical Publications, 2020.

Title of the course : EMBEDDED SYSTEM

Course code : C-19

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual Knowledge	CO3	CO1, CO2,CO6		CO5		
Conceptual Knowledge		CO2, CO3,CO4	CO5	CO1, CO3		
Procedural Knowledge		CO1,CO5	CO3		CO4	
Metacognitive Knowledge	CO6					

Mapping of Course Outcomes to Program Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M	M	S	S	S	M	M	L	S	L	M
CO2	M	M	S	S	S	M	M	L	S	L	M
CO3	S	M	M	S	S	M	S	M	S	M	M
CO4	M	M	S	S	M	M	M	M	S	M	M
CO5	M	M	S	S	S	S	M	M	M	L	M
CO6	M	M	S	S	S	M	M	S	S	M	M

Title of the Course	**:**	**DIGITAL IMAGE PROCESSING**
Course Code	**:**	**C - 19**
Nature of the Course	**:**	**Major**
Total Credits	**:**	**04**
Distribution of Marks	**:**	**End Sem: 45 TH + 15 PR, In-Sem:30 TH + 10 PR**

COURSE OBJECTIVES:

- To understand the basic concepts of digital image processing.
- To introduce the image transformation techniques.
- To familiarize with various image enhancement techniques in spatial and frequency domain.
- To introduce the image compression techniques.
- To understand different image segmentation techniques.

UNITS	CONTENTS	L	T	P	Total Hours
1 **(Marks)** **10 TH + 4 PR**	**Digital Image Fundamentals:** Digital Image representation, Fundamental steps in Image processing, Elements of digital Image processing systems, Types of Images, Image acquisition, Sampling and Quantization.	09	01	05	15
2 **(Marks)** **10 TH + 5 PR**	**Image Transforms:** Need for Image transform, Fourier Transform, 2D Discrete Fourier Transform, Properties of 2D DFT, Discrete Cosine Transform, and Haar transforms.	09	01	05	15
3 **(Marks)** **10 TH + 6 PR**	**Image Enhancement:** Image Enhancement in the spatial domain, Image Enhancement in the frequency domain.	14	01	08	23
4 **(Marks)** **10 TH**	**Image Compression:** Image Compression Models, Image Compression Measures, Huffman Coding.	06	01	01	08
5 **(Marks)** **5 TH**	**Image Segmentation:** Introduction to Image Segmentation, Detection of discontinuities, Edge Linking, Thresholding.	12	01	01	14
Total (in Hrs)		**50**	**05**	**20**	**75**

Where, L: Lectures T: Tutorials P: Practicals

MODES OF IN-SEMESTER ASSESSMENT: (40 Marks)

- One Internal(TH) Examination - **10 Marks**
- One Internal(PR) Examination - **10 Marks**
- Others - **20 Marks**
    - Quiz
    - Seminar presentation
    - Assignment

COURSE OUTCOMES:

After the completion of this course, the learner will be able to:

CO 1: Understand the fundamentals of digital image processing systems.

CO 2: Learn the significance of various image transformation techniques.

CO 3: Understand image enhancement techniques in the spatial and frequency domain.

CO 4: Learn the image segmentation algorithms.

CO 5: Understand the various image compression techniques.

CO 6: Apply the basic image processing techniques for solving real problems.

SUGGESTED READINGS/REFERENCES:

1. R. C. Gonzalez, R. E. Woods,"Digital Image Processing", 3rd Edition,Pearson Education, 2008.
2. A. K. Jain,"Fundamentals of Digital Image Processing", Prentice Hall of India. 1989.
3. K. R. Castleman, "Digital Image Processing", Pearson Education. 1996.
4. Schalkoff, "Digital Image Processing and Computer Vision", John Wiley and Sons,1989.
5. Rafael C. Gonzalez, Richard E.Woods, Steve Eddins, "Digital Image Processing usingMATLAB", Pearson Education, Inc., 2004.

Title of the Course : DIGITAL IMAGEPROCESSING Course
Code : C - 19

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	**Remember**	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge		CO1, CO2, CO3, CO5				
Conceptual Knowledge		CO3, CO4, CO5	CO2			
Procedural Knowledge		CO3, CO4, CO5	CO2,CO3,CO4, CO5, CO6	CO3,CO4, CO5	CO3,CO4, CO5	CO6
Metacognitive Knowledge						

Mapping of Course Outcomes to Program Outcomes

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	M	M	S	M	M	M	S	M	S	S	S
CO2	M	M	S	S	S	S	S	S	S	S	S
CO3	S	M	S	S	S	S	S	S	S	S	S
CO4	S	M	S	S	S	S	S	S	S	S	S
CO5	S	M	S	S	S	S	S	S	S	S	S
CO6	S	S	S	S	S	S	S	S	S	S	S

Title of the Course : NATURAL LANGUAGE PROCESSING
Course Code : C-20
Nature of the Course : Major
Total Credits : 04
Distribution of Marks : 60 TH (End Sem) + 40 (In-Sem)

COURSE OBJECTIVES:

- To introduce the basic text processing techniques
- To introduce morphology, POS tagging and Syntax Analysis
- To illustrate advanced techniques in semantic analysis
- To introduce to information extraction and text classification techniques.
- To illustrate Deep learning techniques for NLP.

UNITS	CONTENTS	L	T	P	Total Hours
1 (10 Marks)	**Introduction to Natural Language Processing:** Introduction to Natural Language Processing (NLP) and its applications, Basic text processing techniques: tokenization, stemming, and lemmatization, Applications of text processing and language modeling in NLP.	09	03	-	12
2 (10 Marks)	**Morphology, Parts of Speech Tagging, and Syntax:** Overview of morphology: word formation, inflection, and derivation, Introduction to parts of speech (POS) tagging and its significance in NLP. Syntax analysis: Probabilistic Context-Free Grammars (PCFGs) and dependency parsing	09	03	-	12
3 (10 Marks)	**Advanced Techniques in Semantic Analysis:** Exploring topic models: Latent Dirichlet Allocation (LDA) and its applications, Distributional semantics: vector space models, word embeddings, and their role in capturing word meanings, Lexical semantics and word sense disambiguation techniques.	09	03	-	12
4 (15 Marks)	**Information Extraction and Text Classification:** Introduction to information extraction: techniques for relation extraction from text, Text classification methods: feature extraction, machine learning models, and evaluation metrics, Sentiment analysis: sentiment classification, sentiment lexicons, and sentiment analysis in social media	09	03	-	12
5 (15 Marks)	**Deep Learning for NLP:** Basics of deep learning models for NLP: neural networks, recurrent neural networks (RNNs), and long short-term memory (LSTM) networks Advanced deep learning models for NLP tasks: attention mechanisms, transformer models (e.g.,	09	03	-	12

	BERT), and sequence-to-sequence models.				
		45	**15**	**-**	**60**

Where, ***L: Lectures*** ***T: Tutorials*** ***P: Practicals***

MODES OF IN-SEMESTER ASSESSMENT: **(40 Marks)**

- Two Internal Examination - **20 Marks**
- Others - **20 Marks**
  - Quiz
  - Seminar presentation
  - Assignment

COURSE OUTCOMES:

After the completion of this course, the learner will be able to:

CO1: Explain the core principles and applications of Natural Language Processing (NLP), including basic text processing techniques like tokenization, stemming, and lemmatization.

CO2: Analyze the structure and formation of words in natural language through morphology and understand the significance of Parts of Speech (POS) tagging and syntax analysis techniques.

CO3: Evaluate the effectiveness of advanced semantic analysis methods such as Latent Dirichlet Allocation (LDA) and distributional semantics approaches like vector space models and word embeddings.

CO4: Critically assess information extraction techniques for relation extraction and evaluate text classification methods, including feature extraction and machine learning models, for sentiment analysis and document classification tasks.

CO5: Analyze the theoretical underpinnings of deep learning models such as neural networks, recurrent neural networks (RNNs), and long short-term memory (LSTM) networks, and evaluate their applications in NLP tasks.

SUGGESTED READINGS/REFERENCES:

1. Jurafsky, Dan. “Speech & Language Processing”, India: Pearson Education, 2020.
2. Hapke, Hannes., Howard, Cole., Lane, Hobson, “ Natural Language Processing in Action: Understanding, Analyzing, and Generating Text with Python”. United States: Manning, 2019.
3. Manning, Christopher., Schutze, Hinrich. “Foundations of Statistical Natural Language Processing”, Cambridge: MIT Press, 1999.

Title of the Course : NATURAL LANGUAGE PROCESSING

Course Code : C-20

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	**Remember**	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge		**CO1**				
Conceptual Knowledge		**CO2,CO3**	**CO1**	**CO4,CO5**		
Procedural Knowledge				**CO2**	**CO3,CO4,CO5**	
Metacognitive Knowledge						

Mapping of Course Outcomes to Program Outcomes

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	S	M	M	S	S	M	M	M	M	M	M
CO2	S	S	M	S	S	M	M	M	M	M	M
CO3	S	M	M	S	S	S	M	M	M	M	M
CO4	S	S	M	S	S	S	M	M	M	M	M
CO5	S	S	S	S	S	S	M	M	M	M	M

Title of the Course	**:**	**SPEECH PROCESSING**
Course Code	**:**	**C-20**
Nature of the Course	**:**	**Major**
Total Credits	**:**	**04**
Distribution of Marks	**:**	**60 TH (End Sem) + 40TH (In-Sem)**

COURSE OBJECTIVES:

- To introduce the characteristics of Speech signals and the related time and frequency domain methods for speech analysis and speech compression
- To introduce the models for speech production
- To develop time and frequency domain techniques for estimating speech parameters
- To introduce a predictive technique for speech compression
- To introduce the concept of speech recognition, synthesis and speaker identification.
-

UNITS	CONTENTS	L	T	P	Total Hours
1 (8 Marks)	**Nature of speech signal:** Speech production: Mechanism of speech production, Acoustic phonetics, Digital models for speech signals, Representations of speech waveform, Sampling speech signals, Basics of quantization, Delta modulation, Differential PCM	09	03	-	12
2 (10 Marks)	**Time domain methods for speech processing:** Time domain parameters of Speech signal, Methods for extracting the parameters: Short-time Energy, Average Magnitude, Short-time average Zero crossing Rate, Auditory perception: psychoacoustics, Silence Discrimination using ZCR and energy, Short Time Auto Correlation Function, Pitch period estimation using Auto Correlation Function	09	03	-	12
3 (12 Marks)	**Frequency domain method for speech processing:** Short Time Fourier analysis: Fourier transform and linear filtering interpretations, Sampling rates, Spectrographic displays, Pitch and formant extraction Analysis by Synthesis, Analysis synthesis systems :Phase vocoder, Channel Vocoder, Homomorphic speech analysis: Cepstral analysis of Speech, Formant and Pitch Estimation, Homomorphic Vocoders	09	03	-	12
4 (15 Marks)	**Linear predictive analysis of speech:** Basic Principles of linear predictive analysis, Auto correlation method, Covariance method, Solution of LPC equations, Cholesky method, Durbin's Recursive algorithm, Application of LPC parameters: Pitch detection using LPC parameters, Formant analysis, VELP, CELP	09	03	-	12

5 (15 Marks)	**Application of speech & audio signal processing:** Algorithms: Dynamic time warping, K-means clustering and Vector quantization, Hidden Markov modeling, Automatic Speech Recognition: Feature Extraction for ASR, Deterministic sequence recognition, Statistical Sequence, Recognition, Language models. Speaker identification and verification, Voice response system, Speech synthesis: Basics of articulatory, Source-filter, Concatenative synthesis	09	03	-	12
		45	**15**	**-**	**60**

Where, ***L: Lectures*** ***T: Tutorials*** ***P: Practicals***

MODES OF IN-SEMESTER ASSESSMENT: **(40 Marks)**

- Two Internal Examination - **20 Marks**
- Others - **20 Marks**
  - Quiz
  - Seminar presentation
  - Assignment

COURSE OUTCOMES:

After the completion of this course, the learner will be able to:

CO1: Recall the mechanisms involved in speech production, including the anatomy of the vocal tract and the processes of speech generation.

CO2: Explain the principles of acoustic phonetics and digital models for speech signals, including sampling techniques and representations.

CO3: Apply time domain analysis techniques such as short-time energy and zero crossing rate to extract parameters from speech signals.

CO4: Analyze speech signals using frequency domain methods like short-time Fourier analysis to extract pitch and formant information.

CO5: Design and implement linear predictive analysis techniques, such as auto-correlation and covariance methods, for tasks like pitch detection and speech synthesis.

SUGGESTED READINGS/REFERENCES:

1. Quatieri, Thomas F. , "Discrete-Time Speech Signal Processing: Principles and Practice", United Kingdom: Pearson Education, 2018.
2. Gold, Ben., Gold, Bernard., Morgan, Nelson., Ellis, Dan. " Speech and Audio Signal Processing: Processing and Perception of Speech and Music", Germany: Wiley, 2011.
3. Deng, Li., O'Shaughnessy, Douglas. "Speech Processing: A Dynamic and Optimization-Oriented Approach.", United States: CRC Press, 2018.

Title of the Course: **SPEECH PROCESSING**

Course Code : **C-20**

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	**Remember**	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge		CO1,CO2				
Conceptual Knowledge		CO1,CO2				
Procedural Knowledge			CO3	CO3,CO4		CO5
Metacognitive Knowledge						

Mapping of Course Outcomes to Program Outcomes

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	S	S	M	M	M	M	M
CO2	S	S	M	S	S	M	M	M	M	M
CO3	S	M	M	S	S	S	M	M	M	M
CO4	S	S	M	S	S	S	M	M	M	M
CO5	S	S	M	S	S	S	M	M	M	M

Title of the course : MOBILE COMPUTING
Course code : C-20
Nature of the course : Major
Total credits : 04
Distribution of Marks : End Sem :45 TH + 15 PR, In-Sem: 30 TH + 10 PR

COURSEOBJECTIVES:

- To discuss different Mobile Terminologies.
- To explain different Mobile Operating Systems.
- To explain the technologies for Mobile Application development.
- To explain different platforms for Mobile Application Development.

UNITS	CONTENTS	L	T	P	Total Hours
1 (Marks) 08 TH	**Mobile Terminology:** Mobile terminology: GSM, CDMA, WAP, GPRS, WCDMA, 3g, 4g, LTE, sensors	07	01	00	08
2 (Marks) 09 TH	**Mobile Operating Systems :** Operating systems concepts, Mobile operating system, Google Android, Apple IOS.	09	01	00	10
3 (Marks) 08 TH + 06 PR	**Technologies for Mobile Application Development :** Java, XML, HTML, CSS, Java Scripts, J-query, C#	09	01	15	25
4 (Marks) 10 TH + 03 PR	**Web Application Vs Mobile Applications:** Use of HTML5 for web application developments. Android application development and Web Application Development , Hybrid Application Development	09	01	10	20
5 (Marks) 10 TH + 06 PR	**Application Development Platforms:** Android studio, Eclipse, NetBeans, Apk-Builder	06	01	05	12
	Total (in Hrs)	40	05	30	75

Where, L:Lectures T: Tutorials P:Practicals

MODES OF IN-SEMESTER ASSESSMENT: (40 Marks)

- One Internal(TH) Examination - **10 Marks**
- One Internal(PR) Examination - **10 Marks**
- Others - **20 Marks**
  - Quiz
  - Seminar presentation
  - Assignment

COURSE OUTCOMES:

After the completion of this course, students would be able to

CO1: Explain the basics of Mobile Computing.

CO2: Use different technologies for mobile applications.

CO3: Learn programming languages needed for Mobile Computing

CO4: Compare Web applications with Mobile applications.

CO5: Develop Mobile Applications for Android device.

SUGGESTEDREADINGS/REFERENCES:

1. Horton. J, "Android Programming for Beginners", Packt Publishing Ltd, Paperback Edition, 2015
2. Shildit. H , "Java: A beginers Guide", McGraw Hill Education, Sixth edition 2014
3. Talukder A., Yavagal A., "Mobile Computing" , Tata McGraw Hill, 2nd edition 2012
4. Horton. J, "Learning Java by Building Android Games", Packt Publishing Ltd, 2015
5. Schiller J., "Mobile Communication" Pearson education, 2nd edition 2014

Title of the course : MOBILE COMPUTING

Course code : C-20

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	**Remember**	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge	CO1	CO3	CO2			
Conceptual Knowledge	CO1	CO3, CO4	CO2		CO4	CO5
Procedural Knowledge	CO1	CO3	CO2			CO5
Metacognitive Knowledge						CO5

Mapping of Course Outcomes to Program Outcomes

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	M	M	L	L	L	L	L	L	L	L	L
CO2	S	S	M	M	M	M	M	M	M	M	M
CO3	M	M	M	M	M	M	M	M	M	M	M
CO4	L	M	L	L	L	L	L	L	L	L	L
CO5	S	S	S	S	S	S	S	S	S	M	S

Title of the Course	**:**	**INTRODUCTION TO ARTIFICIAL INTELLIGENCE**
Course Code	**:**	**Minor - 8**
Nature of the Course	**:**	**Minor**
Total Credits	**:**	**04**
Distribution of Marks	**:**	**60 TH (End Sem) + 40TH (In-Sem)**

COURSE OBJECTIVES:

- To introduce the concept of Artificial Intelligence and its related fields like Machine Learning.
- To instruct on defining a problem as a state space search and the issues in designing the search problem.
- To explain different search techniques.
- To introduce the basic concepts of propositional and predicate logic and their applications in AI.
- To explain knowledge representation and different issues in knowledge representation.

UNIT	CONTENTS	L	T	P	Total Hours
1 (10Marks)	**Overview of AI:** Introduction to AI, Importance of AI, AI and its related field (Machine Learning), AI techniques, Criteria for success.	09	03	-	12
2 (15 Marks)	**Problems, problem space, and search:** Defining the problem as a state space search, Production system, and its characteristics, Issues in the design of the search problem.	09	03	-	12
3 (15 Marks)	**Search techniques:** Basic search methods, Concept of Heuristic search, Generate and test, hill climbing, Basics of constraint satisfaction problems	09	03	-	12
4 (10Marks)	**Propositional Logic:** Basic concepts of propositional logic, truth-table, predicate logic, quantifiers.	09	03	-	12
5 (10Marks)	**Knowledge Representation:** Definition and importance of knowledge, Knowledge representation, Various approaches used in knowledge representation, Issues in knowledge representation.	09	03	-	12
	Total (in Hrs)	**45**	**15**	-	**60**

Where, L: Lectures T: Tutorials P: Practical

MODES OF IN-SEMESTER ASSESSMENT: (40 Marks)

- Two Internal Examination - **20 Marks**
- Others - **20 Marks**
    - o Quiz
    - o Seminar presentation
    - o Assignment

COURSE OUTCOMES:

After the completion of this course, the learners will be able to

CO1. Understand the importance of AI and its related fields like Machine Learning.
CO2. Define a problem as a state space search and identify the issues in designing the search problem.
CO3. Apply various search techniques like basic search methods, heuristic search, generate and test, and hill climbing.
CO4. Use propositional and predicate logic to solve problems in AI.
CO5. Represent knowledge using various approaches and address the issues in knowledge representation.

SUGGESTED READINGS/ REFERENCES:

1. David W. Rolston, "Principles of Artificial Intelligence and Expert System Development", McGraw Hill, 2019.
2. Elaine Rich, Kevin Knight: "Artificial Intelligence", Tata McGraw Hill, 2019.
3. D.W. Patterson, "Introduction to AI and Expert Systems", PHI, 2018.
4. Russell, S., Norvig, P., "Artificial Intelligence: A Modern Approach". CreateSpace Independent Publishing Platform,2016.

Title of the Course : INTRODUCTION TO ARTIFICIAL INTELLIGENCE
Course Code : Minor-8

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	**Remember**	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge	CO2	CO1	CO2			
Conceptual Knowledge	CO2	CO1	CO2, CO3, CO4, CO5			
Procedural Knowledge			CO3, CO4, CO5			
Metacognitive Knowledge						

Mapping of Course Outcomes to Program Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	L	L	M	L	L	L	S	M	M	M	S
CO2	M	M	M	M	M	M	S	M	M	M	S
CO3	M	M	M	S	S	S	S	M	M	M	S
CO4	M	M	M	S	S	S	S	M	M	M	S
CO5	M	M	M	S	S	S	S	M	M	M	S

Title of the course : **MACHINE LEARNING USING PYTHON**
Course code : **Minor-8**
Nature of the course : **Minor**
Total credits : **04**
Distribution of Marks : **End Sem :45 TH + 15 PR, In-Sem: 30 TH + 10 PR**

COURSE OBJECTIVES:

- To develop the skills required for Machine Learning Technologies with use of Python
- To analyze data and solving Machine Learning problems.

UNITS	CONTENTS	L	T	P	Total Hours
1 (Marks) 5TH + 2PR	**Introduction to Python** Python Installation with various IDE's , Python data Types , Control Structure , Functions	07	01	00	08
2 (Marks) 10TH + 3PR	**List, Tuples and Dictionary** Introduction to list, Accessing list, list operations, Working with lists, Function and Methods, Introduction to tuple, Accessing tuples, Operations, Working, Functions and Methods, Introduction to dictionaries, Accessing values in dictionaries, Working with dictionaries, Properties, Functions.	08	01	06	15
3 (Marks) 5 TH + 3PR	**Data analysis and Exploration** Data Analysis & visualization – using • numpy, • panda • matplotlib, • scipy etc	09	01	10	20
4 (Marks) 25 TH + 5 PR	**Machine learning & Its Applications** Supervised machine learning , Unsupervised machine learning , Study of various machine learning algorithms including Classification, Regression, KNN, K Means, Logistic Regression, Support Vector Machines (SVM), Decision Tree, Naïve Bayes, Ensemble Methods, Random Forest.	09	01	10	20
5 (Marks) 2PR	**Mini Project/Prediction**	06	01	05	12
	Total (in Hrs)	**40**	**05**	**30**	**75**

where, ***L: Lectures*** ***T: Tutorials*** ***P: Practicals***

MODES OF IN-SEMESTER ASSESSMENT: (40 Marks)

- One Internal(TH) Examination - **10 Marks**
- One Internal(PR) Examination - **10 Marks**
- Others - **20 Marks**
  - Quiz
  - Seminar presentation
  - Assignment

COURSE OUTCOMES:

After the completion of this course, the learner will be able to:

CO1:Understand various learning models, methods and applications under supervised and unsupervised learning.
CO2: Understand data preprocessing for Machine Learning.
CO3: Implement Data Manipulation using Numpy, Pandas and Matplotlib
CO4: Evaluate and visualize the performance of various machine learning algorithm
CO5: Solve real world problems through machine learning implementation leading to predictions..

SUGGESTED READINGS/REFERENCES:

1. Müller, Andreas C., and Sarah Guido. Introduction to machine learning with Python: a guide for data scientists. " O'Reilly Media, Inc.", 2016.
2. Mueller, John Paul. Beginning programming with Python for dummies. JohnWiley & Sons, 2023.
3. Raschka, Sebastian. Python machine learning. Packt publishing ltd, 2015.
4. Sarkar, Dipanjan, Raghav Bali, and Tushar Sharma. "Practical machine learningwith Python." Book" Practical Machine Learning with Python (2018): 25-30.

Title of the course : MACHINE LEARNING USING PYTHON
Course code : Minor-8

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	**Remember**	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge						
Conceptual Knowledge		**CO1, CO2**	**CO3**	**CO4**	**CO4**	**CO5**
Procedural Knowledge		**CO1, CO2**	**CO3**		**CO4**	
Metacognitive Knowledge						**CO5**

Mapping of Course Outcomes to Program Outcomes

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	**M**	**M**	**S**	**M**	**S**	**L**	**M**	**S**	**S**	**S**	**S**
CO2	**M**	**M**	**S**	**M**	**S**	**M**	**S**	**M**	**S**	**S**	**S**
CO3	**L**	**M**	**M**	**M**	**M**	**M**	**S**	**S**	**S**	**S**	**S**
CO4	**S**	**M**	**M**	**M**	**S**	**S**	**S**	**S**	**M**	**M**	**M**
CO5	**S**	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**M**	**M**	**S**

Title of the course : **WIRELESS COMMUNICATION NETWORKS**
Course code : **Minor-8**
Nature of the course : **Minor**
Total credits : **04**
Distribution of Marks : **60TH(End Sem)+ 40TH(In-Sem)**

COURSE OBJECTIVES:

- To understand the functions of wireless communication network and the standards.
- To learn the technologies used in wireless communication.
- To understand the architecture and protocols used in wireless communication network.
- To learn security issues associated with wireless network.

UNITS	CONTENT	L	T	P	Total Hour
1 (12 marks)	**Overview of wireless communication**: Cellular communication, different generations and standards in cellular communication system, satellite communication including GPS, wireless local loop, cordless phone, paging systems, RFID.	10	01	00	11
2 (12 Marks)	**Recent wireless technologies**: Multicarrier modulation, OFDM, MIMO system, diversity-multiplexing trade-off, smart-antenna; cognitive radio, communication relays, spectrum sharing.	10	01	00	11
3 (12 Marks)	**Multiple access techniques in wireless communication**: Contention-free multiple access schemes, contention-based multiple access schemes.	11	01	00	12
4 (12 Marks)	**Wireless Networks**: Wireless personal area networks (Bluetooth, UWB and ZigBee), wireless local area networks, wireless metropolitan area networks (WiMAX).	10	01	00	11
5 (12 Marks)	**Ad-hoc wireless networks**: Design Challenges in Ad-hoc wireless networks, concept of cross layer design, security in wireless networks, energy constrained networks. MANET and WSN. **Wireless system protocols** : Mobile network layer protocol (mobile IP, IPv6, dynamic host configuration protocol), mobile transport layer protocol (traditional TCP, classical TCP improvements), support for mobility (wireless application protocol).	14	01	00	15
	Total (in Hrs)	55	05	00	60

Where, L:Lectures T: Tutorials P:Practicals

MODES OF IN-SEMESTER ASSESSMENT: **(40Marks)**

- Two Internal Examinations **20Marks**
- Others **20Marks**
  - Quiz
  - Seminar presentation
  - Assignment

COURSE OUTCOMES:

After the completion of this course, the learner will be able to

CO1: Describe the functioning of wireless communication network.
CO2: Compare and contrast the technologies used in wireless communication network.
CO3: Explain the architecture, protocols and applications of wireless communication network.
CO4: Evaluate design challenges, constraints and security issues associated with Ad-hoc wireless networks.
CO5: Analyze the wireless installation and deployment techniques in real-world networks.

SUGGESTED READINGS/ REFERENCES:

1. Theodore S Rappaport, Wireless Communications, Principles and Practice, Pearson Education Asia, 2nd edition, 2009, ISBN: 9780133755367.

2. Vijay K.Garg, Wireless Communications and Networking, Morgan Kaufmann Publishers, Indian Reprint, 2009,ISBN: 978-81-312-1889-1.

3. William Stallings, Wireless Communications and Networks, Pearson Education Asia, 2nd edition, 2005, ISBN 13: 9780131918351.

4. Sassan Ahmadi, LTE-Advanced – A practical systems approach to understanding the 3GPP LTE Releases 10 and 11 radio access technologies, Elsevier, 2014

Title of the course : WIRELESS COMMUNICATION NETWORKS

Course code : Minor-8

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	**Remember**	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge						
Conceptual Knowledge		**CO1,CO2**	**CO2**	**CO2**	**CO4**	
Procedural Knowledge			**CO3**	**CO5**		
Meta cognitive Knowledge					**CO5**	

Mapping of Course Outcomes to Program Outcomes

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	**L**	**M**	**M**	**M**	**S**	**L**	**M**	**S**	**S**	**S**	**S**
CO2	**M**	**M**	**S**	**M**	**S**	**M**	**S**	**M**	**S**	**S**	**S**
CO3	**L**	**M**	**M**	**M**	**M**	**M**	**S**	**S**	**S**	**S**	**S**
CO4	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**S**
CO5	**S**	**S**	**M**	**S**	**M**	**M**	**L**	**L**	**L**	**L**	**S**

Title of the Course	**:**	**BIG DATA ANALYTICS**
Course Code	**:**	**DSE01**
Nature of the Course	**:**	**DSE**
Total Credits	**:**	**04**
Distribution of Marks	**:**	**End Sem : 45 TH + 15 PR, In-Sem:30 TH + 10 PR**

COURSE OBJECTIVES:

- Provide an overview of Big Data and Apache Hadoop
- Provide HDFS Concepts and Interfacing with HDFS
- Illustrate Map Reduce Jobs
- Provide hands on Hodoop Eco System
- Apply analytics on Structured, Unstructured Data.
- Exposure to Data Analytics with R.

UNITS	CONTENTS	L	T	P	Total Hours
1 (Marks) 5 TH + 2 PR	**Introduction to Big data and Hadoop** Types of digital data, introduction to big data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System.	5	01	02	08
2 (Marks) 10 TH + 2 PR	**HDFS(Hadoop Distributed File System)** The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.	8	01	06	17
3 (Marks) 10 TH + 3 PR	**Map Reduce** Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.	8	01	06	17
4 (Marks) 10TH + 4 PR	**Hadoop Eco System** Pig : Introduction to PIG, Execution Modes of Pig, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive : Hive Shell, Hive Services, Hive Metastore, HiveQL, Tables, Querying Data and User Defined Functions. Hbase : HBasics, Concepts, Clients, Hbase Versus RDBMS. Big SQL : Introduction.	11	01	10	17
5 (Marks) 10 TH + 4 PR	**Data Analytics with R** Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering, Big Data Analytics with R, Case studies and real-world applications across industries. Use of Cloud platforms like AWS, Google Cloud Platform, or Microsoft Azure for practical exercises and projects.	8	01	06	15
	Total (in Hrs)	**40**	**05**	**30**	**75**

Where, ***L: Lectures*** ***T: Tutorials*** ***P: Practicals***

MODES OF IN-SEMESTER ASSESSMENT: **(40 Marks)**

- One Internal(TH) Examination - **10 Marks**
- One Internal(PR) Examination - **10 Marks**
- Others - **20 Marks**
    - Quiz
    - Seminar presentation
    - Assignment

COURSE OUTCOMES:

After the completion of this course, the learner will be able to:

CO1: Describe the core principles of big data and the Hadoop ecosystem, including HDFS and MapReduce.

CO2: Demonstrate the use of Unix tools and Hadoop for data analysis, including data ingestion with Flume and Sqoop, and data processing with Pig and Hive.

CO3: Analyze the data flow in HDFS and MapReduce job execution, identifying and addressing performance bottlenecks.

CO4: Evaluate the differences and use cases of HDFS, Hive, HBase, and RDBMS, and big data analytics techniques using R.

CO5: Design and implement end-to-end big data analytics solutions using Hadoop components and cloud platforms like AWS, Google Cloud, or Microsoft Azure.

SUGGESTED READINGS/REFERENCES:

1. Acharya, S., Chellappan, S., "Big Data Analytics", Wiley Publications 2015.
2. N.p , R Programming: “An Approach to Data Analytics”., MJP Publisher, 2019.
3. R. P. Jain and S. K. Jain, “Introduction to Information Technology,” New Delhi, India: Firewall Media, 2015.
4. Jain, V. K., “Big Data and Hadoop”, India: Khanna Book Publishing, 2017.
5. Bhushan, Mayank. “BIG DATA AND HADOOP: Learn by example”, India: BPB Publications, 2018.
6. Bahga, Arshdeep., Madisetti, Vijay. “Big Data Science & Analytics: A Hands-on Approach.”, United States: Arshdeep Bahga & Vijay Madisetti, 2016.
7. Bengfort, Benjamin., Kim, Jenny. “Data Analytics with Hadoop: An Introduction
8. for Data Scientists.”, United States: O'Reilly Media, 2016.

Title of the Course : BIG DATA ANALYTICS

Course Code : DSE01

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual Knowledge						
Conceptual Knowledge		**CO1,CO2**	**CO2**	**CO2**	**CO4**	
Procedural Knowledge			**CO3**	**CO5**		
Meta cognitive Knowledge					**CO5**	

Mapping of Course Outcomes to Program Outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	**L**	**M**	**M**	**M**	**S**	**L**	**M**	**S**	**S**	**S**	**S**
CO2	**M**	**M**	**S**	**M**	**S**	**M**	**S**	**M**	**S**	**S**	**S**
CO3	**L**	**M**	**M**	**M**	**M**	**M**	**S**	**S**	**S**	**S**	**S**
CO4	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**S**
CO5	**S**	**S**	**M**	**S**	**M**	**M**	**L**	**L**	**L**	**L**	**S**
CO6	**S**	**S**	**S**	**S**	**S**	**S**	**L**	**M**	**S**	**S**	**M**

Title of the Course	**:**	**DISTRIBUTED COMPUTING**
Course Code	**:**	**DSE02**
Nature of the Course	**:**	**DSE**
Total Credits	**:**	**04**
Distribution of Marks	**:**	**End Sem: 45 TH + 15 PR, In-Sem:30 TH + 10 PR**

COURSE OBJECTIVES:

- To explain the concepts and importance of distributed systems.
- To give an overview of network communication in distributed systems.
- To familiarize with message passing in a distributed system.
- To explain the importance of clock synchronization and Management in Distributed Systems.
- To describe different Distributed Computing approaches.

UNITS	CONTENTS	L	T	P	Total Hours
1 (Marks) 10 TH	**Fundamentals of Distributed Systems and Network Communication in Distributed Systems:** Definition and goals of a Distributed System, Types of Distributed Systems, Design issues in Distributed Systems, LAN and WAN technologies, OSI Model and Internet protocols for Distributed Systems, Client-Server Model.	05	01	00	06
2 (Marks) 10 TH + 05 PR	**Inter-Process and Remote Communication:** Message passing and its features, IPC Message format, IPC Synchronization, Buffering, Multi Datagram Messaging, Encoding and Decoding of Message Data, Process Addressing, Failure Handling, Group Communication. The RPC Model, Transparency of RPC, RPC Implementation, RMI basics and Implementation.	10	01	06	17
3 (Marks) 5 TH + 5 PR	**Distributed System Synchronization and Management:** Clock Synchronization, Logical Clocks, Global State, Event Ordering, Mutual Exclusion, Election Algorithms, and Deadlocks in Distributed Systems.	13	01	08	22
4 (Marks) 10 TH + 5 PR	**Distributed Shared Memory,Naming and Distributed File Systems:** Basic concepts of DSM and DFS, Design and Implementation Issues in DSM systems, Heterogeneous and Other DSM Systems. Desirable Features of a Good Naming System, Systems-	12	01	06	19

	Oriented Names, Object Locating Mechanism, Issues in Designing Human-oriented Names, Name Caches Naming & security, DNS.				
5 (Marks) 10 TH	**Distributed Computing Approaches:** Global State and Snapshot Recording Algorithms, Distributed Mutual Exclusion (Non-token-based Approach, Quorum based Approach, Token-based Distributed Approach), Consensus and Agreement Algorithms, Deadlock Detection in Distributed Systems (Path-Pushing, Edge Chasing, Diffusion Computation, and Global State Detection), Message Ordering and Group Communication.	10	01	00	11
Total (in Hrs)		**50**	**05**	**20**	**75**

where, ***L: Lectures*** ***T: Tutorials*** ***P: Practicals***

MODES OF IN-SEMESTER ASSESSMENT: (40 Marks)

- One Internal(TH) Examination - **10 Marks**
- One Internal(PR) Examination - **10 Marks**
- Others - **20 Marks**
  - Quiz
  - Seminar presentation
  - Assignment

COURSE OUTCOMES:

After the completion of this course, the learner will be able to:

CO 1: Understand the fundamentals of distributed systems and networking.

CO 2: Learn the concepts of various aspects of Inter-process and Remote communication in distributed systems.

CO 3: Understand the concepts of various algorithms for synchronization and resource management for distributed systems and shared memory.

CO 4: Understand the principles and basic concepts of distributed computing model.

CO 5: Learn various distributed computing algorithms in detail.

SUGGESTED READINGS/REFERENCES:

1. Sinha, P.K., "Distributed operating systems: concepts and design", PHI Learning Pvt. Ltd.1998.
2. Liu, M.L., "Distributed Computing: principles and applications", Pearson Education Inc., 2003.
3. Lynch, N.A., "Distributed algorithms", Elsevier, 1996.

Title of the Course : DISTRIBUTED COMPUTING
Course Code : DSE02

Cognitive Map of Course Outcomes with Bloom's Taxonomy

Knowledge Dimension	**Remember**	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge		CO1, CO4				
Conceptual Knowledge		CO2	CO3	CO3	CO3	
Procedural Knowledge			CO2	CO2	CO2	
Metacognitive Knowledge						

Mapping of Course Outcomes to Program Outcomes

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	M	M	M	S	S	M	S	M	S	S	S
CO2	S	S	S	S	S	S	S	M	M	S	S
CO3	S	S	S	S	S	S	S	S	S	S	S
CO4	M	M	S	S	S	M	S	S	S	S	S