माँ शाकुम्भरी विश्वविद्यालय, सहारनपुर
Maa Shakumbhari University, Saharanpur

B.Voc. (Information Technology)

Under FYUP-NEP2020 PROGRAMME

CURRICULUM & SYLLABUS

For

Department of Computer Science

Affiliated Colleges

Maa Shakumbhari University, Saharanpur

(Effective from Session 2025-26)

संकायाध्यक्ष विज्ञान
माँ शाकुम्भरी विश्वविद्यालय
सहारनपुर

Members, Board of Studies (Computer Science)

Maa Shakumbhari University, Saharanpur

S.No.	Name	Designation	College/Universit
1.	Prof. Praveen Kumar	Member	J. V. Jain College, Saharanpur
2.	Prof. Naveen Sharma	Member	D.A.V. College Muzaffarnagar
3.	Dr. Jay Prakash	Member	Mahant Avaidyanath Government Degree College, Jungle Kaudiya, Gorakhpur UP
4.	Prof. Karamjit Bhatia	Member(External)	Gurukul Kangri Deemed to be University, Haridwar, UK
5.	Prof. Mahesh Sharma	Member(External)	TIET (Deemed to be University), Patiala, PB

Programme Objectives (POs)

PO1: Understand the fundamental concepts of computers, software hardware and peripheral devices and evolution of computer technologies.
PO2: Familiarized with business environment and information technology and its applications in different domains.
PO3: Gain knowledge to identify, explain and apply functional programming and object-oriented programming techniques and use of databases to develop computer programs.
PO4: Analyze, design, implement and evaluate computerized solutions to real life problems, using appropriate computing methods including web applications.
PO5: Understand the front end and backend of software applications.
PO6: Gain expertise in at least one emerging technology.
PO7: Acquire knowledge about computer networks, network devices and their configuration protocols, security concepts at various level etc.
PO8: Apply techniques of software validation and reliability analysis to the development of computer programs.
PO9: Acquire technical, communication and management skills to convey or present information, applications, instructions, policies, procedures, decisions, documentations etc. verbally as well as in writing.
PO10: Recognize the various issues related to society, environment, health and vivid cultures and understand the responsibilities to contribute in providing the solutions.
PO11: Acquire technical skills to lead a productive life in the society as a professional or as an entrepreneur

Programme Learning Outcomes(PLO):

PLO1: Communication Skills
The student should be able to communicate the technical information both orally and in writing professionally.
PLO2: Use of Software Tools
Create, select, adapt and apply suitable tools and technologies to a wide range of computational activities.
PLO3: Technical Skills
Acquire necessary knowledge of technical, scientific as well as basic managerial and financial procedures to analyze and solve real world problems within their work domain
PLO4: Domain Awareness
Clarity on both conceptual and application oriented skills in commerce, finance & accounting and it applications in business context.
PLO5: Technical Support

Must be able to provide technical support for various software applications.

PLO6: Analysis and investigation of Complex Computing Problems

Ability to analyze research and investigate complex computing problems through design of experiments, analysis and interpretation of data and synthesis of the information to arrive at valid conclusions.

PLO7: Design / Development of Solutions

Apply the knowledge gained in core courses to a broad range of advanced topics in computer science, to learn and develop sophisticated technical products independently.

PLO8: Imbibe Cyber Ethics

Awareness on ethics, values, sustainability and creativity aspects of technical solutions.

Syllabus

B.Voc.(IT) 904 as per NEP2020

SEMESTER	PAPER CODE	PAPER TYPE	COURSE NAME	TH/PRC/PR	CR	IE (TH)	IE (PR)	EE (MinMarks)	Total	Min Marks
	Certificate in Information Technology									
Sem-I	0190401	CC	Computer Fundamentals	TH	4	25		75(25)	100	33
	0190402	CC	Programming in C	TH	4	25		75(25)	100	33
	0190480	CC	Lab-Programming in C	PRC	4			100(33)	100	33
	0190060	SEC	Office Automation	TH+PRC	3	40	60		100	40
		CCME	*Choose From Other Faculty*	TH	6	25		75(25)	100	33
	0180101	AEC	First Aid and Basic Health	TH	2			100(33)	100	33
SEM-II	0290401	CC	Operating Systems	TH	4	25		75(25)	100	33
	0290402	CC	Data Structure using C	TH	4	25		75(25)	100	33
	0290480	CC	Lab-Data Structure using C	PRC	4			100(33)	100	33
	0290060	SEC	English Communication Practical: Group Discussion, Presentation & Picture report writting	TH+PR	3	40	60		100	40
	0280101	AEC	Human Values and Environmental Studies	TH	2			100(33)	100	33
	Diploma in Information Technology									
Sem-III	0390401	CC	Digital System Architecture	TH	4	25		75(25)	100	33
	0390402	CC	Data Base Management Systems	TH	4	25		75(25)	100	33
	0390480	CC	Lab-Data Base Management Systems	PRC	4			100(33)	100	33
		CCME	*Choose From Other Faculty*	TH	6	25		75(25)	100	33

	0390060	SEC	Business Intelligence & Analytics	TH+PRC	3	40	60		100	40
	0380101	AEC	Physical Education and Yoga	TH	2			100(33)	100	33
Sem-IV	0490401	CC	Web Designing with PHP & HTML	TH	4	25		75(25)	100	33
	0490402	CC	Python Programming	TH	4	25		75(25)	100	33
	0490480	CC	Lab-Python Programming	PRC	4			100(33)	100	33
	0480101	AEC	Social Responsibility and Community Engagement	TH	2			100(33)	100	33
	0490465	SEC-PR	Minor Project/ Internship **(Designing own ERP/e-commerce website/etc)	PR	3		100		100	40
	Bachelor Vocational Degree in Information Technology									
Sem-V	0590401	CC	JAVA Programming	TH	4	25		75(25)	100	33
	0590402	CC	Designing & Analysis of Algorithms	TH	4	25		75(25)	100	33
	0590403	CC	Computer Graphics	TH	4	25		75(25)	100	33
	0590480	CC	Lab- Computer Graphics & JAVA Programming	PRC	2+2			100(33)	100	33
	0590465	SEC-PR	Project-I	PR	4		100		100	40
Sem-VI	0690401	CC	Artificial Intelligence	TH	4	25		75(25)	100	33
	0690402	CC	Software Engineering	TH	4	25		75(25)	100	33
	0690403	CC	Computer Networks	TH	4	25		75(25)	100	33
	0690480	CC	Lab-Artificial Intelligence using Python	PRC	4			100(33)	100	33
	0690465	SEC-PR	Project-II	PR	4			100(40)	100	40
CC-Core Compulsory, SEC-Skill Enhancement Course, AEC-Ability Enhancement Course, EL-Elective, CR-Credits, IE-Internal Evaluation, EE-External Evaluation, TH-Theory, PRC-Practical, PR-Project										

माँ शाकुम्भरी विश्वविद्यालय, सहारनपुर
Maa Shakumbhari University, Saharanpur

B.Voc.(IT) with Apprenticeship Embedded Program

Under FYUP-NEP2020 PROGRAMME

CURRICULUM & SYLLABUS

For

Department of Computer Science

Affiliated Colleges

Maa Shakumbhari University, Saharanpur

(Effective from Session 2025-26)

Syllabus B.Voc.(IT) with Apprenticeship Embedded Program as per NEP2020

SEMESTER	PAPER CODE	PAPER TYPE	COURSE NAME	TH/PRC/PR	CR	IE (TH)	IE (PR)	EE (MinMarks)	Total	Min Marks
	Certificate in Information Technology									
Sem-I	0190401	CC	Computer Fundamentals	TH	4	25		75(25)	100	33
	0190402	CC	Programming in C	TH	4	25		75(25)	100	33
	0190480	CC	Lab-Programming in C	PRC	4			100(33)	100	33
	0190060	SEC	Office Automation	TH+PRC	3	40	60		100	40
		CCME	*Choose From Other Faculty*	TH	6	25		75(25)	100	33
	0180101	AEC	First Aid and Basic Health	TH	2			100(33)	100	33
SEM-II	0290401	CC	Operating Systems	TH	4	25		75(25)	100	33
	0290402	CC	Data Structure using C	TH	4	25		75(25)	100	33
	0290480	CC	Lab-Data Structure using C	PRC	4			100(33)	100	33
	0290060	SEC	English Communication Practical: Group Discussion, Presentation & Picture report writting	TH+PR	3	40	60		100	40
	0280101	AEC	Human Values and Environmental Studies	TH	2			100(33)	100	33
	Diploma in Information Technology									
Sem-III	0390401	CC	Digital System Architecture	TH	4	25		75(25)	100	33
	0390402	CC	Data Base Management Systems	TH	4	25		75(25)	100	33
	0390480	CC	Lab-Data Base Management Systems	PRC	4			100(33)	100	33
		CCME	*Choose From Other Faculty*	TH	6	25		75(25)	100	33
	0390060	SEC	Business Intelligence & Analytics	TH+PRC	3	40	60		100	40

संकायाध्यक्ष विज्ञान
...भारती विश्वविद्यालय
...पुर

	0380101	AEC	Physical Education and Yoga	TH	2			100(33)	100	33
Sem-IV	0490401	CC	Web Designing with PHP & HTML	TH	4	25		75(25)	100	33
	0490402	CC	Python Programming	TH	4	25		75(25)	100	33
	0490480	CC	Lab-Python Programming	PRC	4			100(33)	100	33
	0480101	AEC	Social Responsibility and Community Engagement	TH	2			100(33)	100	33
	0490465	SEC-PR	Minor Project/ Internship **(Designing own ERP/e-commerce website/etc)	PR	3		100		100	40
	Bachelor Vocational Degree in Information Technology									
Sem-V	0590401	CC	JAVA Programming	TH	4	25		75(25)	100	33
	0590402	CC	Designing & Analysis of Algorithms	TH	4	25		75(25)	100	33
	0590403	CC	Computer Graphics	TH	4	25		75(25)	100	33
	0590480	CC	Lab- Computer Graphics & JAVA Programming	PRC	2+2			100(33)	100	33
	0590465	SEC-PR	Project-I	PR	4		100		100	40
Sem-VI	0690401	CC	Artificial Intelligence	TH	4	25		75(25)	100	33
	0690402	CC	Software Engineering	TH	4	25		75(25)	100	33
	0690403	CC	Computer Networks	TH	4	25		75(25)	100	33
	0690480	CC	Lab-Artificial Intelligence using Python	PRC	4			100(33)	100	33
	0690465	SEC-PR	Project-II	PR	4			100(40)	100	40
	B.Voc.(IT) with Apprenticeship Embedded Program									
Sem-VII & VIII	**0790460**	CC	Internship/Apprenticeship(From NATS or Equivalent Organisation)		40	1200 Hrs				

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माँ शाकुम्भरी विश्वविद्यालय, सहारनपुर
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B.Voc.(IT) Honours

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माँ शाकुम्भरी विश्वविद्यालय
सहारनपुर

Syllabus Structure B.Voc.(IT) Honours as per NEP2020

SEMESTER	PAPER CODE	PAPER TYPE	COURSE NAME	TH/PRC/PR	CR	IE (TH)	IE (PR)	EE (MinMarks)	Total	Min Marks
	Certificate in Information Technology									
Sem-I	0190401	CC	Computer Fundamentals	TH	4	25		75(25)	100	33
	0190402	CC	Programming in C	TH	4	25		75(25)	100	33
	0190480	CC	Lab-Programming in C	PRC	4			100(33)	100	33
	0190060	SEC	Office Automation	TH+PRC	3	40	60		100	40
		CCME	*Choose From Other Faculty*	TH	6	25		75(25)	100	33
	0180101	AEC	First Aid and Basic Health	TH	2			100(33)	100	33
SEM-II	0290401	CC	Operating Systems	TH	4	25		75(25)	100	33
	0290402	CC	Data Structure using C	TH	4	25		75(25)	100	33
	0290480	CC	Lab-Data Structure using C	PRC	4			100(33)	100	33
	0290060	SEC	English Communication Practical: Group Discussion, Presentation & Picture report writting	TH+PR	3	40	60		100	40
	0280101	AEC	Human Values and Environmental Studies	TH	2			100(33)	100	33
	Diploma in Information Technology									
Sem-III	0390401	CC	Digital System Architecture	TH	4	25		75(25)	100	33
	0390402	CC	Data Base Management Systems	TH	4	25		75(25)	100	33
	0390480	CC	Lab-Data Base Management Systems	PRC	4			100(33)	100	33
		CCME	*Choose From Other Faculty*	TH	6	25		75(25)	100	33
	0390060	SEC	Business Intelligence & Analytics	TH+PRC	3	40	60		100	40

	0380101	AEC	Physical Education and Yoga	TH	2			100(33)	100	33
Sem-IV	0490401	CC	Web Designing with PHP & HTML	TH	4	25		75(25)	100	33
	0490402	CC	Python Programming	TH	4	25		75(25)	100	33
	0490480	CC	Lab-Python Programming	PRC	4			100(33)	100	33
	0480101	AEC	Social Responsibility and Community Engagement	TH	2			100(33)	100	33
	0490465	SEC-PR	Minor Project/ Internship **(Designing own ERP/e-commerce website/etc)	PR	3		100		100	40
	Bachelor Vocational Degree in Information Technology Honours									
Sem-V	0590401	CC	JAVA Programming	TH	4	25		75(25)	100	33
	0590402	CC	Designing & Analysis of Algorithms	TH	4	25		75(25)	100	33
	0590403	CC	Computer Graphics	TH	4	25		75(25)	100	33
	0590404	CC	Cloud computing	TH	4	25		75(25)	100	33
	0590480	CC	Lab- Computer Graphics & JAVA Programming	PRC	2+2			100(33)	100	33
	0590465	SEC-PR	Project-I	PR	5		100		100	40
Sem-VI	0690401	CC	Artificial Intelligence	TH	4	25		75(25)	100	33
	0690402	CC	Software Engineering	TH	4	25		75(25)	100	33
	0690403	CC	Computer Networks	TH	4	25		75(25)	100	33
	0690404	CC	Machine Learning	TH	4	25		75(25)	100	33
	0690480	CC	Lab-Artificial Intelligence & Machine Learning using Python	PRC	2+2			100(33)	100	33
	0690465	SEC-PR	Project-II	PR	5			100(40)	100	40

CC-Core Compulsory, SEC-Skill Enhancement Course, AEC-Ability Enhancement Course, EL-Elective, CR-Credits, IE-Internal Evaluation, EE-External Evaluation, TH-Theory, PRC-Practical, PR-Project

Examination Pattern

Practical Examination: 100 Marks external

Continuous Internal Evaluation: 25 Marks (15 Marks Written exam + 05 Marks Quiz + 05 Marks Class performance and Regularity)

External Examination: Written Exam of 75 marks 3Hrs Duration.

External Exam Pattern:

Section-A: Attempt all five question. Each question carries 3 marks.

Section-B: Attempt Any Two out of three. Each Question carry 7.5 marks each.

Section-C: Attempt Any Three out of Five. Each Question carry 15 marks each.

Minimum Marks:

I- Semester to VI-Semester

1. In each individual paper Thirty Three Marks i.e. 33%.
2. Division: First Division - CGPA 6.5 and Less than 10, Second division - CGPA 5.0 and less than 6.5. Third division - CGPA 4.0 and less than 5.0.

Equivalent Percentage = CGPA x 9.5

Note: Percentage and Grading system applicable as per NEP2020 GO 1032/Sattar-2022-08(35)/2020, Higher Education Division -3, Lucknow Dated 20.04.2022

Year- I Semester-I

Course Name: Computer Fundamentals

Course Outcomes:

CO1 Describe the usage of computers and why computers are essential components in business and society.

CO2 Understanding the concept of Computer memory and input/output devices of Computers and how it works and recognize the basic terminology used in computer programming.

CO3 Demonstrate the use of Operating system commands. Understand the basic concepts of computational thinking, including sequential logic, abstractions and problem-solving techniques.

CO4 Possess the ability to design and develop programs to solve basic computational problems, develop algorithms and flowcharts. Explain the working of important application software and their use to perform any engineering activity.

CO5 Possess the ability to extend their knowledge towards learning behavior on windows operating system and Hands on training on MS Office Automation.

Course Name: Computer Fundamentals		
Course Code: 0190401	**Marks IE/EE: 25/75**	**Max. Marks(IE+EE): 100**
Credits: 4	**Core Compulsory**	**Passing Marks: 33**

Unit	Details	Lecture Hours
I	Introduction to Computers: Introduction, Characteristics of Computers, Block diagram of computer. Types of computers and features, Mini Computers, Micro Computers, Mainframe Computers, Super Computers. Types of Programming, Languages (Machine Languages, Assembly Languages, High Level Languages). Data Organization, Drives, Files, Directories, Number Systems Introduction to Binary, Octal, Hexadecimal system Conversion, Binary, Arithmetic Simple Addition, Subtraction, Multiplication	12
II	Memory Organization: Types of Memory (Primary And Secondary) RAM, ROM, PROM, EPROM. Secondary Storage Devices (FD, CD, HD, Pen drive) I/O Devices (Scanners, Plotters, LCD, Plasma Display). Cache, Virtual memory, RAID.	12
III	The Internet: Introduction to networks and internet, history, Internet, Intranet & Extranet, Working of Internet, Modes of Connecting to Internet. Electronic Mail: Introduction, advantages and disadvantages, User Ids, Passwords, e-mail addresses, message components, message composition, mailer features. Browsers and search engines.	12
IV	Problem solving techniques: Understanding the problem, Analyzing the problem, Developing the solution, Algorithm and Flowcharts - Definition, Characteristics, Expressing Algorithms, Analysis of Algorithms, Advantages and disadvantages, Examples Flowchart: Definition, Define symbols of flowchart, Limitations of Using Flowcharts, Advantages and disadvantages, Activities involved in Program Design, Coding and implementation.	12
V	Threats: Physical & non-physical threats, Virus, Worm, Trojan, Spyware, Keylogers, Rootkits, Adware, Cookies, Phishing, Hacking, Cracking. Computer Security Fundamentals: Confidentiality, Integrity, Authentication, Non-	12

	Repudiation, Security Mechanisms, Security Awareness, Security Policy, anti-virus software & Firewalls, backup & recovery.	

Suggested Books:

1. Fundamental of Computers – By V. Rajaraman B.P.B. Publications
2. Fundamental of Computers – By P.K. Sinha
3. Computer Today- By SureshBasandra
4. Unix Concepts and Application – By SumitabhaDas
5. MS-Office 2000(For Windows) – By SteveSagman1

Year- I Semester-I

Course Name: Programming in C

Course Outcomes:

CO1 Able to understand the basic knowledge of Computer fundamental and its application in computers.

CO2 Able to understand the basic knowledge of Computer fundamental and its application in computers.

CO3 Able to design and develop various programming problems using C programming concepts.

CO4 Able to Implement advance C programming concepts like function, pointer, structure and Union

CO5 Able to understand the file handling using C Programming language.

Course Name: Programming in C		
Course Code: 0190402	**Marks IE/EE: 25/75**	**Max. Marks(IE+EE): 100**
Credits: 4	**Core Compulsory**	**Passing Marks: 33**

Unit	Details	Lecture Hours
I	Fundamentals of C programming and Control Structures: History, Structure of a C program, C Conventions, Character Set, Identifiers, Keywords, Simple Data types, Modifiers, Variables, Constants, Operators, Operator precedence. Input and Output operation: Single character input and output, formatted input and output. Control Structures, Conditional statement and switch statement. Goto statement. Looping statement, break and continue, nested for statement.	12
II	Arrays and Functions: Introduction (One and multi-dimensional), Declaration of arrays, Initialization of arrays, processing with arrays. String manipulation, declaration of string arrays, string operations. Functions: Introduction, advantages of functions, Function definition, function call, Actual and formal arguments, local and global variables, function prototypes, types of functions, recursive functions, arrays and functions.	12
III	Searching and Sorting: selection sort, bubble sort, insertion sort, quick sort, merge sort Searching: linear and binary search methods, comparison of sorting and searching methods.	12
IV	Structures and Pointers: Introduction to structures, Advantages of structures,	12

	accessing elements of a structure, nested structures, array of structures, functions and structures, Pointers: Introduction, pointer variable, pointer operator, pointer arithmetic, pointers and arrays, pointers and strings, array pointers, dynamic allocation.	
V	Files, Preprocessor, standard library and header files: Files: Introduction, File data type, opening and closing a file, file functions (getc, putc, getw, putw, fscanf, fprintf, fread, fwrite, fgets, fputs, feof). Preprocessor: #define, #include, #undef, Conditional compilation directives, C standard library and header files: Header files, string functions, mathematical functions, Date and Time functions	12

Suggested Books:

1. Let us C-Yashwant Kanetkar.
2. Programming in C-Balguruswamy
3. The C programming Lang., Pearson Ecl – Dennis Ritchie
4. Structured programming approach using C- Forouzah & Ceilber Thomson learning Publication.
5. Pointers in C – Yashwant Kanetkar
6. How to solve it by Computer – R.G. Dromy

Year- I Semester-I

Skill Enhancement Course Name: Office Automation

Skill Enhancement Course Name: Office Automation		
Course Code: 0121259/0190060	**Marks IE/PRC: 40/60**	**Max. Marks(IE+PRC): 100**
Credits: 3	**Core Compulsory**	**Passing Marks: 40**

Unit	Details	Lecture Hours
I	Introduction to Office Automation Suit, Elements of Office Suit & Area of Use. WordProcessing, Spreadsheet, Presentation Graphics, Database. Introduction of various Office Suites Open Office, Libre Office, WPS Office, Microsoft Office. Word Basics Using MS Office : Starting Word Processor, The parts of a Word Processor Window, Menus & Commands, Toolbars & Buttons, Shortcut Menus, Creating a New Document, Different Page Views and Layouts, Applying various Text Enhancements, Formatting Text and Documents: Auto Format, Text Attributes, Paragraph and Page Formatting, Line Spacing, Margins, Borders and Shading, Tabs and Indents, Text Editing using various features, Bullets, Numbering, Working with Styles, Printing & various print options, Spell Check ,Working with Headers and Footers, Tables: Creating a Simple Table, Creating a Table using the Table Menu, Entering and Editing Text in a Table, Selecting in Table, Adding Rows, Changing Row Heights, Deleting Rows, Inserting Columns, Deleting Columns, Changing Column Width.	10
II	Graphics: Clipart, Insert Picture, Using Drawing Features, Drawing Objects, Text in Drawing. Templates: Template Types, Using Templates, Exploring Templates, Modifying Templates. Macros: Macro, Recording Macros, Editing Macros, Running a Macro. Mail Merge: Mail Merge Concept, Main Document, Data Sources, Merging Data Source and Main Document	5
III	Spreadsheet Basics: Overview of Spreadsheet, Features, Creating a New Worksheet, Selecting Cells, Entering and Editing Text, Entering and Editing	5

	Numbers, Entering and Editing Formulas, Referencing Cells, Moving Cells, Copying Cells, Sorting Cell Data, Inserting Rows, Columns, Inserting Cells, Deleting Parts of a Worksheet, Clearing Parts of a Worksheet. Formatting: Page Setup, Changing Column Widths and Row Heights, Auto Format, Changing Font Sizes and Attributes, Using Border Buttons and Commands, Changing Colors and Shading, Hiding Rows and Columns.	
IV	Function in Spreadsheet, Functions by category: Date and Time functions, Engineering functions, Math and Trigonometry functions, Statistical functions, Text functions. Spreadsheet Charts: Chart parts and Terminology, Instant Charts with the Chart Wizard, Creation of different types of Charts, Printing Charts, Deleting Charts, L:inking in Spreadsheet. Spreadsheet Graphics: Creating and Placing Graphic Objects, Resizing Graphics, Drawing Lines and Shapes.	5
V	Creating Presentations: Using Blank Presentation Option, Using Design Template , Adding Slides, Deleting a Slide, Importing Images from Outside, Transition and Build Effects, Deleting a Slide, Numbering a Slide, Saving Presentation, Closing Presentation, Printing Presentation .	5

Suggested Books:

1. Microsoft Office Ste by Step Beth Melton,Mark Dodge , Published with the authorization of Microsoft Corporation by: O'Reilly Media.
2. Office 2013 Bible: The Comprehensive Tutorial Resource Paperback – by Lisa A. Bucki (Author), John Walkenbach (Author), Michael Alexander.
3. Learning Microsoft Office 2013 by Ramesh Bangia, Khanna Publishers
4. www.openoffice.org/documentation/manuals/.../0100GS3- GettingStartedOOo3.pdf
5. Open Office for Dummies (https://whc.es/OpenOffice%20org%20For%20Dummies.pdf)
6. https://www.libreoffice.org/get-help/documentation/
7. Libre Office 5.1 Writer, Calc, Math Formula Book- Vol 1 by Lalit mali

Year- I Semester-II

Course Name: Operating Systems

Course Outcomes:

CO1 Understand the basics of operating systems like kernel, shell, types and views of operating systems.

CO2 Describe the various CPU scheduling algorithms and remove deadlocks.

CO3 Explain various memory management techniques and concept of thrashing

CO4 Use disk management and disk scheduling algorithms for better utilization of external memory.

CO5 Recognize file system interface, protection and security mechanisms.

CO6 Explain the various features of distributed OS like Unix, Linux, windows etc

Course Name: Operating Systems		
Course Code: 0290401	**Marks IE/EE: 25/75**	**Max. Marks(IE+EE): 100**
Credits: 4	**Core Compulsory**	**Passing Marks: 33**

Unit	**Details**	**Lecture Hours**
I	Introduction, What is an operating system, Simple Batch Systems, Multi-programmed Batch systems, TimeSharing Systems, Personal – Computer Systems, Parallel systems, Distributed systems, Real- Time Systems. Memory Management: Background, Logical versus physical Address space, swapping, Contiguous allocation, Paging, Segmentation Virtual Memory: Demand Paging, Page Replacement, Page- replacement Algorithms, Performance of Demand Paging, Allocation of Frames, Thrashing, Other Considerations	12
II	Processes: Process Concept, Process Scheduling, Operation on Processes CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multiple – Processor Scheduling.	12
III	Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock	12
IV	Device Management: Techniques for Device Management, Dedicated Devices, Shared Devices, Virtual Devices; Input or Output Devices, Storage Devices, Buffering.	12
V	Information Management: Introduction, A Simple File system, General Model of a File System, Symbolic File System, Basic File System, Access Control Verification, Logical File System, Physical File system File – System Interface; File Concept, Access Methods, Directory Structure, Protection.	12

Suggested Books:

1. Silbersachatz and Galvin, " Operating System Concepts", Person, 5th Ed.2001
2. Madnick E., Donovan J., " Operating Systems, Tata McGrawHill,2001
3. Tannenbaum, "Operating Systems", PHI, 4th Edition,2000

Year- I Semester-II

Course Name: Data Structure using C

Course Outcomes:

CO1 Understand the structure, syntax, and semantics of the C language.

CO2 Solve real world problems by applying the C Data Structures, Objects, Functions and Modules.

CO3 Apply the basics of data science using advanced Python libraries.

CO4 Build practical applications in C.

Course Name: Data Structure using C		
Course Code: 0290402	**Marks IE/EE: 25/75**	**Max. Marks(IE+EE): 100**
Credits: 4	**Core Compulsory**	**Passing Marks: 33**

Unit	**Details**	**Lecture Hours**
I	Introduction to Data Structure and its Characteristics Array Representation of single and multidimensional arrays; Sparse arrays – lower and upper triangular matrices and Tri-diagonal matrices with Vector Representation also.	12
II	Stacks and Queues Introduction and primitive operations on stack; Stack application; Infix, postfix, prefix expressions; Evaluation of postfix expression; Conversion between prefix, infix and postfix, introduction and primitive operation on queues, D- queues and priority queues.	12
III	Lists Introduction to linked lists; Sequential and linked lists, operations such as traversal, insertion, deletion searching, two way lists and Use of headers	12
IV	Trees Introduction and terminology; Traversal of binary trees; Recursive algorithms for tree operations such as traversal, insertion, deletion; Binary Search Tree	12
V	Graphs: Graph terminology, Representation of graphs, path matrix, BFS (breadth first search), DFS (depth first search), topological sorting, Warshall's algorithm (shortest path algorithm.)	12

Suggested Books:

1. E. Horowiz and S. Sahani, " Fundamentals of Data structures", Galgotia Book source Pvt. Ltd., 2003
2. R.S. Salaria, " Data Structures & Algorithms" , Khanna Book Publishing Co. (P)Ltd..,2002
3. Y. Langsam et. Al., " Data Structures using C and C++" , PHI,1999

Year-I Semester-II

Skill Enhancement Course Name: English Communication

Skill Enhancement Course Name: English Communication			
Course Code: 0221259/0290060	**Marks IE/PRC: 40/60**	**Max. Marks(IE+PRC): 100**	
Credits: 3	**Core Compulsory**	**Passing Marks: 40**	

Unit	Details	Lecture Hours
I	Communication Skills: An Introduction Definition and Process of Communication. Types of communication: Formal and Informal, Verbal, Non-verbal, Written, Technical and Business Communication, Barriers to Successful Communication, the 7Cs of Effective Communication.	5
II	Elevating Your Vocabulary : Active and Passive Vocabulary, Etymology, Single-word substitution, Synonyms, Antonyms, Prefixes and Suffixes, Idioms, Phrasal Verbs, Adjectives and Adverbs	5
III	Refining Grammar Skills: Parts of speech, Subject-Verb agreement, Tenses, Articles, Prepositions, Pronouns, Modal Verbs, Wh- Questions, Yes/No Questions, Common errors.	5
IV	Listening Skills: Active Listening, Hearing vs Listening, Listening to Short Lecture, Recipe, Telephone conversation, Interview, Self-Introduction, Description of Objects.	5
V	Speaking Skills: Self-Introduction, Just a Minute, Picture Description, Role Plays, Interview Skills, Oral Presentation, Group Discussion.	5
VI	Reading Skills: Reading Strategies, Skimming and Scanning, Reading Poetry, Extracts from Fiction, Reading Comprehension Techniques, Pre-While-Post Reading Techniques, Inference and Summarising	5
VII	Writing Skills: Writing Letters, Paragraphs, Reports, Essays, E-mails, Notices, Minutes of a Meeting, Job Application, CV/Resume writing, Correspondence, Business and Official, Notices (including Press Release).	5
VIII	Soft Skills for Professional Excellence: Soft Skills and Hard Skills. Importance of Soft Skills and Etiquette, Life skills, Adaptability, Empathy, Problem Solving, Decision-Making Skills, Critical Thinking and Creativity, Leadership and Teamwork, Time Management.	5

Suggested Books:

1. Biswajit Das and Ipseeta Satpathy 2009. Business Communication and Personality Development. Excel Books, New Delhi.
2. Jaidka, Kuldip. 2015. Rich Vocabulary Made Easy Mohindra Capital Publishers, Chandigarh.
3. Murphy, Raymond. 2018. Intermediate English Grammar, Cambridge University Press.
4. Shoba, K.N. and Lourdes Jovani Rayen. 2018. Communicative English: A Workbook, Cambridge University Press, New Delhi
5. Shoba, K.N et al. 2023. English for Science and Technology. Cambridge University Press, New Delhi

MOOCs Online: SWAYAM "Communication Skills in English"

By Dr. Shoba. K.N. | National Institute of Technical Teachers Training and Research, Chennai

Year- II Semester-III

Course Name: Digital System Architecture

Course Objective(s)

To provide an understanding of computers' various components and functional units, their design and working. To provide insight into digital systems and logic circuit design.

Course Outcomes COs:

CO1 Identify and describe basic components of computer systems and its functionality.
CO2 Explain number systems and representations.
CO3 Design and implement various logic circuits.
CO4 Analyze various types of combinational and sequential circuits and their functions.
CO5 Describe the basic organization of a computer.

Course Name: Digital System Architecture		
Course Code: 0390401	**Marks IE/EE: 25/75**	**Max. Marks(IE+EE): 100**
Credits: 4	**Core Compulsory**	**Passing Marks: 33**

Unit	Details	Lecture Hours
I	Basic computer organization and design, Instructions and instruction codes, Timing and control/ instruction cycle, Register/ Types of register/ general purpose & special purpose registers/ index registers, Register transfer and micro operations/ register transfer instructions, Memory and memory function, Bus/ Data transfer instructions, Arithmetic logic micro-operations/ shift micro-operations, Input/ Output and interrupts, Memory reference instructions, Memory interfacing memory/ Cache memory.	12
II	Central Processing Unit: General Register Organization/ stacks organizations instruction formats, addressing modes, Data transfer and manipulation. Program control reduced computer, pipeline/ RISC/ CISC pipeline vector processing/ array processing. Arithmetic Algorithms: Integer multiplication using shift and add, Booth's algorithm, Integer division, Floating-point representations.	12
III	Computer Arithmetic:Addition, subtraction and multiplication algorithms, divisor algorithms. Floating point, arithmetic operations, decimal arithmetic operations, decimal arithmetic operations.	12
IV	Input – Output Organization: Peripheral devices, Input/output interface, ALU Asynchronous Data transfer, mode of transfer, priority interrupts, Direct memory Address (DMA), Input/ Output processor (IOP), serial communication.	12
V	Evaluation of Microprocessor: Overview of Intel 8085 to Intel Pentium processors Basic microprocessors, architecture and interface, internal architecture, external architecture memory and input/ output interface. Assembly language, Assembler, Assembly level instructions, macro, use of macros in I/C instructions, program loops, programming arithmetic and logic subroutines, Input-Output programming.	12

Suggested Books:

1. Leventhal, L.A, "Introduction to Microprocessors", Prentice Hall of India .
2. Mathur, A.P., "Introduction to Microprocessors" , Tata McGraw Hill
3. Rao,P.V.S., "Prospective in Computer Architechture" , Prentice Hall of India
4. J. Glenn Brookshear,"Computer Science: An Overview", Addision-Wesley, 12th ed. 2014.
5. Computer Organization – Carl Hamacher, ZvonksVranesic, SafeaZaky, Vth Ed., McGraw Hill.
6. Computer Systems Architecture – M.Moris Mano, IIIrd Edition, Pearson/PHI

Year-II Semester- III

Course Name: Data Base Management System

Course Objective(s):

The objective of the course is to present an introduction to database management systems, with an emphasis on how to organize, maintain and retrieve - efficiently, and effectively - information from a DBMS.

Course Outcomes COs:

CO1 Master the basic concepts of DBMS and its types. Understand the concepts of data independence and three schema architecture.

CO2 Be familiar with the CODD's rules and E-R Model and also have clear picture about the structure of the relational databases.

CO3 Master the concept of normalization and different types of normalization. Design normalised database objects and process the data in an optimized way.

CO4 Be familiar with the basics of query evaluation techniques and query optimization and to get a clear picture about transaction processing.

CO5 Comprehend the conversion of queries into relational algebra and to construct query transactions having atomic, consistent, isolated and durable properties.

Course Name: Data Base Management System		
Course Code: 0390402	**Marks IE/EE: 25/75**	**Max. Marks(IE+EE): 100**
Credits: 4	**Core Compulsory**	**Passing Marks: 33**

Unit	**Details**	**Lecture Hours**
I	Introduction to Data and Database. Significance of Database Management System, Various Types of DBMS. Data Independence - The Three Levels of Architecture - The External Level - Conceptual Level - Internal Level - Client/Server Architecture- System Structure, Instance and Schema.	12
II	Keys - CODD's Rules, Design Issues -ER – Model –Attribute types- Weak Entity Sets - Extended ER Features –ER to Relational Mapping, Structure Of Relational Databases, Creation and Manipulation of Database using Basic SQL(DDL, DML, DCL, TCL)	12
III	Normalization –Anomalies- Functional Dependency: Armstrong's axioms- closure of a relation and closure of attribute– Lossless decomposition-1NF, 2NF, 3NF, Boyce - Codd Normal Form	12
IV	The Relational Algebra: Introduction, Selection and projection, set operations, renaming, Joins, Division, syntax, semantics. Operators, grouping and ungrouping, relational comparison. Calculus: Tuple relational calculus, Domain relational Calculus, calculus vs algebra, computational capabilities. Query Processing and Optimization: Evaluation of Relational algebra expressions, Query Equivalence-Transaction Processing: ACID properties, states of a transaction- Introduction to concurrency control-Deadlock-Recovery	12
V	Constraints, Views and SQL: What is constraints, types of constrains, Integrity constraints, Views: Introduction to views, data independence, security, updates on views, comparison between tables and views SQL: data definition, aggregate function, Null Values, nested sub queries, Joined relations. Triggers.	12

Suggested Books:

1. Silberschatz Korth. Sudarshan: Database System Concepts - 6thEdition McGraw-Hill Intl. Ed.
2. Ivan Bayross: Sql- PL/SQL The Programming Language of Oracle- 4rd Edition- Bpb Publications
3. C.J. Date: An Introduction To Database Systems - Eighth Edition - PearsonEducation Asia
5. "Fundamentals of Database Systems" by Elmasri and Navathe

Year-II Semester-III

Skill Enhancement Course Name: Business Intelligence & Analytics

Skill Enhancement Course Name: Business Intelligence & Analytics		
Course Code: 0321259/0390060	**Marks IE/PRC: 40/60**	**Max. Marks(IE+PRC): 100**
Credits: 3	**Core Compulsory**	**Passing Marks: 40**

Unit	Details	Lecture Hours
I	Introduction to Business Intelligence & Analytics (BIA), drivers of BIA, types of analytics: descriptive to prescriptive, vocabulary of business analytics, course plan and resources	5
II	Technical architecture of BIA, case analysis of AT&T Long distance, fundamentals of data management, OnLine Transaction Processing (OLTP), design process of databases	5
III	Relational databases, normalisation, SQL queries, ShopSense case of management questions, data warehousing, OnLine Analytical Processing (OLAP), data cube	5
IV	Descriptive analytics, and visualization, customer analytics, survival analysis, customer lifetime value, case study	5
V	Introduction to classification, classification techniques, scoring models, classifier performance, ROC and PR curves	5
VI	Introduction to decision trees, tree induction, measures of purity, tree algorithms, pruning, ensemble methods	5
VII	Tree implementation in Python: problem of targeted mailing	5
VIII	Cluster analysis, measures of distance, clustering algorithms, K-means and other techniques, cluster quality	5
IX	A store segmentation case study using clustering, implementation in Python, profiling clusters, cluster interpretation and actionable insights, RFM sub-segmentation for customer loyalty	5
X	Data mining process, introduction to statistical learning, data pre-processing, data quality, overview of data mining techniques, case study using regression analysis	5
XI	Machine learning, Artificial Neural Networks (ANN), topology and training algorithms, back propagation, financial time series modelling using ANN, implementation in Python	5
XII	Text mining, process, key concepts, sentiment scoring, text mining using R-the case of a movie discussion forum, summary	5

Suggested Books:

1. Han, J., Pei, J. & Tong H. (2023). Data Mining Concepts and Techniques, 4th ed, New Delhi: Elsevier.
2. James, G., Witten, D., Hastie, T. and Tibshirani,R. (2013) An Introduction to Statistical Learning with Applications in R, Springer: NY

MOOCs on SWAYAM: "Business Intelligence & Analytics" By Prof. Saji K Mathew, IIT Madras

Year- II Semester-IV

Course Name: Web Designing with PHP & HTML

Course Objective(s)

Web Technologies course is intended to give the student a comprehensive understanding of latest Internet and web programming tools. The student will be introduced to client side and server side scripting and standards.

Course Outcomes:

CO1 Get familiarized with basic web programming technologies and be equipped with the latest web development tools.
CO2 Use HTML syntax and semantics to build web pages.
CO3 Create Client-Side Scripts using JavaScript and Server-Side Scripts using PHP.
CO4 Create web pages that can interact with databases and manage sessions.
CO5 Apply industrial standards and frameworks for creating web applications.

Course Name: Web Designing with PHP & HTML		
Course Code: 0490401	**Marks IE/EE: 25/75**	**Max. Marks(IE+EE): 100**
Credits: 4	**Core Compulsory**	**Passing Marks: 33**

Unit	Details	Lecture Hours
I	Introduction : Basic principles involved in developing a web site, Planning process , Domains and Hosting, Responsive Web Designing , Types of Websites (Static and Dynamic Websites), Web Standards and W3C recommendations, Introduction to HTML: What is HTML , HTML Documents, Basic structure of an HTML document , Creating an HTML document , Mark up Tags , Heading-Paragraphs , Line Breaks.	12
II	Elements of HTML: HTML Tags., Working with Text, Working with Lists, Tables and Frames, Working with Hyperlinks, Images and Multimedia, Working with Forms and controls	12
III	Introduction to PHP, History of PHP, Versions of PHP, Features of PHP, Advantages of PHP over Other Scripting Languages, software requirements, Installation and Configuration of PHP, Installing and Configuring Apache to use PHP on Windows, Basic HTML, Embedding PHP in HTML, PHP Basic syntax, data types, comments, variables and constants, scope of variables, PHP arrays: creating array and accessing array elements, PHP String, PHP operators, precedence of operators, expressions, creating a PHP Script, running a PHP script.	12
IV	PHP conditional statements, switch case, PHP looping statements, while, for and do while loop, break, continue, exit, PHP functions: built-in and user defined function, declaration and calling of a function, function argument with call by value, call by reference, string manipulation, mathematical, date and time functions. Introduction to a web form, processing a web form, capturing form data, passing information between pages, PHP $_GET, PHP $_POST, with multi value fields, validating a web form, input validation, exception and error handling, introduction to cookies and session handling. UNIT- IV Working with database: PHP supported databases, using PHP & MySQL: Installation and configuration of MySQL on windows, checking configuration, connecting to database, selecting a database, adding table and altering table in a database, inserting, deleting and modifying data in a table, retrieving data, performing queries, processing result sets.	12

V	Code re-use, require(), include(), and the include_path, PHP file permissions, working with files: opening, closing, reading, writing a file, file system functions and file input and output, working with directory: creating, deleting, changing a directory, file uploads, introduction to object oriented programming with PHP. Web Hosting: Web Hosting Basics, Types of Hosting Packages, Registering domains, Defining Name Servers, Using Control Panel, Creating Emails in cpanel , Using FTP Client, Maintaining a Website Concepts of SEO: Basics of SEO, Importance of SEO, On page Optimization Basics.	12

Suggested Books:

1. Steven M. Schafer, "HTML, XHTML, and CSS Bible, 5ed", Wiley India
2. Ian Pouncey, Richard York, "Beginning CSS: Cascading Style Sheets for Web Design", Wiley India
3. Robin Nixon, "Learning PHP, MySQL &JavaScript with jQuery, CSS and HTML5", 5th Edition, O'Reilly Publications, 2018.
4. The Complete Reference, HTML and CSS by Thomas A Powell latest Edition
5. Zak Ruvalcaba Anne Boehm, "Murach's HTML5 and CSS3", 3rdEdition, Murachs/Shroff Publishers & Distributors Pvt Ltd, 2016.
6. Luke Welling, Laura Thomson, "PHP and MySQL Web Development", 5th Edition, Pearson Education, 2016. (ISBN:978-9332582736)
7. Joe Fawcett, Danny Ayers, Liam R. E. Quin , Beginning XML, 5th Edition, 2012, WILEY.

Year- II Semester-IV

Course Name: Python Programming

Course Objectives:

To Introduce Python Programming Language as Multipurpose Programming Language with Features and Applications.
To Learn Installing Python and Introducing Cross Multiplatform Usage of Python.
To Practice Basic Language Features of Python and Implement Oops Concepts Using Python.
Learn core python structures and flow control, Create and run python functions
Explore the python library functions for various purpose

Course Outcomes:

CO1 Install and use Python on Various Platform.
CO2 Understand and Explain various features of Python language
CO3 Design and Develop Python applications for data analysis using object oriented concept
CO4 Build package and modules in Python with reusability and exception Asp

Course Name: Python Programming		
Course Code: 0490402	**Marks IE/EE: 25/75**	**Max. Marks(IE+EE): 100**
Credits: 4	**Core Compulsory**	**Passing Marks: 33**

Unit	Details	Lecture Hours
I	Python: Features of Python, Environmental setup, Installation and tools required for running, Basic Types Variable types and operators : Assigning values to variables Multiple Assignments Standard Data Types Set Map Single line comments using Multi-line comments using triple quote, Data Type Conversion Operators, Types of Operator, Conditional statement, Looping statements with else-Pass-Break continue.	12
II	Number and List: Accessing values in List-Delete, update List element-Basic List operationsIndexing, Slicing and Matrices Built in methods and Functions for List-Accessing values in TupleDelete, List element-Basic Tuple operations Indexing, Slicing and Matrices Built in methods and Functions for Tuple.	12
III	Dictionary and Function: Accessing values in Dictionary-Updating Dictionary-Deleting Dictionary –elementsProperties of Dictionary keys-Built in Dictionary Functions and Methods Defining Function-Calling function- Pass by reference vs value Function Arguments-Required arguments-Keyword arguments-Default arguments-Variable length arguments Recursion.	12
IV	Modules and Packages: The Time Module and its functions-Calendar modules and its functionsOther modules and Functions Sum and Difference f time and date Import From import statement From import statement Executing modules, Local functions-Reload function Packages in Python.	12
V	Exception handling: Exception handling and assertions-Standard Exceptions-Assertions in Python-Handling an exception-Except clause with no exception-Except Clause with multiple exception-Try-Finally Clause-Argument of an Exception Raising an Exception.	12

Suggested Books:

1. Tony Gaddis, Starting Out with Python, 3rd edition, Pearson
2. Y. Daniel Liang, Introduction to Programming Using Python, Pearson
3. Budd T A, Exploring Python , 2011, Tata McGraw Hill Education
4. Learning Python, Fourth Edition, Mark Lutz, O'Reilly publication

Year- III Semester- V

Course Name: JAVA Programming

Course Objective(s): The course aims to provide a thorough understanding of the core concepts of object-oriented programming, including classes, objects, inheritance, polymorphism, encapsulation, and abstraction. Students will grasp the principles behind OOP and learn how to apply them effectively in Java.

Course Outcomes COs:

CO1 Identify classes, objects, members of a class and relationships among them needed for a specific problem.

CO2 Write Java application programs using OOP principles and proper program structuring.

CO3 Demonstrate the concepts of polymorphism, inheritance and thread and document a Java Program using Javadoc.

CO4 Understand and Implement Generics and Collection Framework.

Course Name: JAVA Programming		
Course Code: 0590401	**Marks IE/EE: 25/75**	**Max. Marks(IE+EE): 100**
Credits: 4	**Core Compulsory**	**Passing Marks: 33**

Unit	**Details**	**Lecture Hours**
I	Java Fundamentals, Java Programming: Data types, control structured, arrays, strings, and vector, classes (inheritance, package, exception handling) multithreaded programming. Objects and Methods, Object Oriented Concepts, Inheritance, Polymorphism, Abstract Classes & Interfaces.	12
II	Exception Handling, Using I/O - Streams, read and write binary files, character streams for file I/O Introduction to Threads, Creating Threads, Thread States, Runnable Threads, Coordinating Threads, Interrupting Threads, Runnable Interface, Synchronization. Java applets, AWT controls (Button, Labels, Combo box, list and other Listeners, menu bar) layout manager, string handling (only main functions)	12
III	JDBC: JDBC Fundamentals, Establishing Connectivity and Working with Connection Interface, Working with Statements, Creating and Executing SQL Statements, Working with ResultSet Objects.	12
IV	Java Servlets: Introduction, HTTP Servlet Basics, The Servlet Lifecycle, Retrieving Information, Sending HTML Information, Session Tracking.	12
V	Java Server Pages: Introducing Java Server Pages, JSP Overview, Setting Up the JSP Environment, Generating Dynamic Content, Using Custom Tag Libraries and the JSP Standard Tag Library, Processing Input and Output.	12

Suggested Books:

1. Herbert Schildt, "Java, A Beginner's Guide", Ninth Edition, McGraw-Hill Education, 2022
2. Ali Bahrami, "Object Oriented Systems Development", Second Edition, McGraw-Hill,2008.
3. Jaime Nino, Fredrick a Hosch, "An Introduction to Programming and Object-Oriented Design using Java", Wiley India Private Limited, 2010
4. Herbert Schildt, "Java: The Complete Reference, Eleventh Edition", Oracle 2018

Year- III Semester- V

Course Name: Designing & Analysis of Algorithm

Course Outcomes:

CO1. Understand the fundamentals of algorithm analysis and design.

CO2. Analyse the time and space complexity of algorithms.

CO3. Apply algorithmic techniques to solve computational problems.

CO4. Design and implement efficient algorithms for real-world scenarios.

CO5. Evaluate and compare different algorithmic approaches for problem solving.

Course Name: Designing and Analysis of Algorithm		
Course Code: 0590402	**Marks IE/EE: 25/75**	**Max. Marks(IE+EE): 100**
Credits: 4	**Core Compulsory**	**Passing Marks: 33**

Unit	**Details**	**Lecture Hours**
I	Introduction to Algorithms Basics of algorithms and problem-solving techniques, Asymptotic analysis: Big-O notation, time and space complexity, Algorithm design paradigms.	12
II	Sorting and Searching Algorithms Bubble Sort, Selection Sort, Insertion Sort, Merge Sort, Quick Sort, Heap Sort, Linear and Binary Search.	12
III	Divide and Conquer Algorithms Binary search, Merge sort, Closest pair problem, Karatsuba multiplication.	12
IV	Dynamic Programming and Greedy Algorithms Fibonacci series, Knapsack problem, Dijkstra's algorithm, Prim's algorithm, Huffman coding.	12
V	Graph Algorithms and NP-Completeness Depth-First Search (DFS) and Breadth-First Search (BFS), Shortest path algorithms, Introduction to NP-Completeness and the P vs. NP problem.	12

Suggested Books:

1. "Introduction to the Design and Analysis of Algorithms" by Anany Levitin.
2. "Algorithm Design Manual" by Steven S. Skiena.

Year- III Semester- V
Course Name: Computer Graphics

Course Outcomes:

CO1 Understand the basics of computer graphics, different graphics systems and applications of computer graphics.

CO2 Discuss various algorithms for scan conversion and filling of basic objects and their comparative analysis.

CO3 Use of geometric transformations on graphics objects and their application in composite form.

CO4 Extract scene with different clipping methods and its transformation to graphics display device.

CO5 Explore projections and visible surface detection techniques for display of 3D scene on 2D screen.

CO6 Render projected objects to naturalize the scene in 2D view and use of illumination models for this.

Course Name: Computer Graphics		
Course Code: 0590403	**Marks IE/EE: 25/75**	**Max. Marks(IE+EE): 100**
Credits: 4	**Core Compulsory**	**Passing Marks: 33**

Unit	**Details**	**Lecture Hours**
I	Introduction: Interactive Computer Graphics, Advantages of Interactive Graphics, Representative Uses of Computer Graphics, Conceptual Framework for Interactive Graphics, Classification of Application Development of Hardware and software for computer Graphics.	12
II	Scan Conversion: Scan Converting Lines, Scan Converting Circles, Scan Converting Ellipses. Clipping: point clipping, Cohen-Sutherland line clipping Algorithm, Midpoint Subdivision Algorithm, polygon clipping (Sutherland-Hodgeman)	12
III	Geometrical Transformation: 2D Transformation (translation, rotation, scaling, reflection and shearing), Homogeneous Coordinates and Matrix Representation of 2D Transformations, Successive and composite 2D Transformations, the Window-to-Viewport Transformations, Introduction to 3D Transformations Matrix.	12
IV	Curves & Surfaces: Polygon Surfaces and polygon meshes, Quadratic and super quadrics surfaces, Spline curve and representation.	12
V	Computer Animation: introduction, Application of animation, Morphing, Keyframe system, Motion specifications in Animation, Types of animation, Sequencing of Animation Design and Fundamental principles of animation.	12

Suggested Books:

1. Foley, Van Dam, Feiner, Hughes, Computer Graphics Principles& practice,2000.
2. D.J. Gibbs & D.C. Tsichritzs: Multimedia programming Object Environment& Frame work, 2000
3. Ralf Skinmeiz and Klana Naharstedt, Multimedia: computing, Communication and Applications, Pearson, 2001
4. D. Haran & Baker. Computer Graphics Prentice Hall of India,1986.1

Year- III Semester- V

Course Name: Cloud Computing

Course Outcomes:

CO1 Define Cloud Computing and memorize the different Cloud service and deployment models

CO2 Describe importance of virtualization along with their technologies.

CO3 Use and Examine different cloud computing services

CO4 Analyze the components of Google Cloud platform

CO5 Describe the key components of Amazon web Service

CO6 Design & develop backup strategies for cloud data based on features.

Course Name: Cloud Computing		
Course Code: 0590404	**Marks IE/EE: 25/75**	**Max. Marks(IE+EE): 100**
Credits: 4	**Core Compulsory**	**Passing Marks: 33**

Unit	**Details**	**Lecture Hours**
I	Introduction to Computing Paradigms: High-Performance Computing, Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing, Cloud Computing, Biocomputing, Mobile Computing, Quantum Computing, Optical Computing, Nano-computing, Network Computing. Cloud Computing Fundamentals: Motivation, Need, Definition of Cloud Computing. Principles of Cloud computing: Five Essential Characteristics, Four Cloud Deployment Models, Three Service Offering Models, Cloud Ecosystem, Requirements for Cloud Services. Cloud Computing Architecture: cloud Architecture, User/Client Layer, Network Layer, Cloud Management Layer, Hardware Resource Layer, , Network Connectivity in Cloud Computing, Public Cloud Access Networking, Private Cloud Access Networking.	12
II	Cloud Computing Management: Cloud Application, Benefits and Drawbacks Applications on the Cloud, Managing the Cloud, Managing the Cloud Infrastructure, Managing the Cloud Application, Migrating Application to Cloud, Cloud Deployment Models: Private Cloud, Outsourced Private Cloud, Community Cloud, On-Premise Community Cloud, Hybrid Cloud. Cloud Service Models: Infrastructure as a Service, : Platform as a Service, Software as a Service, Introduction to Open Source Tools for IaaS, Paas & SaaS : Apache.	12
III	Technological Drivers for Cloud Computing: SOA and Cloud, SOA and SOC, Benefits of SOA, Multi-core Technology: Multi-core Processors and VM Scalability, Memory and Storage Technologies, Cloud Storage Requirements, Networking Technologies, Web 2.0 : Characteristics, Difference from Web 1.0, Applications, Social Media, Marketing, Education. Web 3.0:Components , Semantic Web, Web Services, Characteristics, Convergence of Cloud and Web 4.0, Connecting Information: Facebook. Agile Software Models: Agile SDLC for Cloud Computing, Features of Cloud SDLC, Agile Software Development Process, Advantages of Agile. Cloud Application Development Platforms: Windows Azure, Google App Engine, Forcecom. IBM Cloud Computing API	12

IV	Virtualization : Full Virtualization, Para virtualization, Hardware-Assisted Virtualization, Hypervisor, OS Virtualization, Server Virtualization, Memory Virtualization, Storage Virtualization, Network Virtualization, Application Virtualization, Processor Virtualization, Memory Virtualization, Storage Virtualization, Network Virtualization, Data Virtualization, Application Virtualization, Hypervisors, Types of Hypervisors, Security Issues and Recommendations. From Virtualization to Cloud Computing VMware. Microsoft Hyper-V.	12
V	Cloud Service Providers ; EMC, EMC IT, Captiva Cloud Toolkit, Google, Cloud Platform, Cloud Storage, Google Cloud Connect, Google Cloud Print, Google App Engine, Amazon Web Services, Amazon Elastic Compute Cloud, Amazon Simple Storage Service, Amazon Simple Queue Service, Microsoft Azure, Microsoft Assessment and Planning Toolkit, SharePoint, IBM SmartCloud. Security in Cloud Computing, Cloud General Challenges,	12

Suggested Books:

1. Essentials of Cloud Computing, K Chandrasekaran, CRC Press [ISBN: 3: 978--4822-0544- 2]
2. Raj Kumar Buyya, James Broberg and rezeiM.Goscinski, -Cloud Computing: Principles and Paradigms,-Wiley 2011.
3. Srinivasan, J.Suresh,-Cloud Computing – a Practical Approach for Learning and Implementation, Pearson India, [ISBN 978131776513]
4. Toby Velte, Anthony Velte, Robert Elsenpeter,-Cloud Computing, a Practical Approach - McGraw Hill, 2010 [ISBN: 0071626948]

Year- III Semester- VI

Course Name: Artificial Intelligence

Course Objective: The course objectives of this course are to:

To introduce basic concepts and techniques of Artificial Intelligence (AI).
To apply informed search techniques for different applications.
To learn various knowledge representation techniques and writing Prolog programs.
To learn about the latest techniques for developing AI systems.

Course Outcomes: On successful completion of this course, students will be able to:

CO1: identify problems that are amenable to solutions by specific AI methods.
CO2: state the utility of different types of AI agents.
CO3: apply different informed search techniques for solving real world problems.
CO4: use knowledge representation techniques for AI systems.

Course Name: Artificial Intelligence		
Course Code: 0690401	**Marks IE/EE: 25/75**	**Max. Marks(IE+EE): 100**
Credits: 4	**Core Compulsory**	**Passing Marks: 33**

Unit	Details	Lecture Hours
I	Introduction: Introduction to artificial intelligence, background and applications, Turing test, Weak AI, Strong AI, Narrow AI, Artificial General Intelligence, Super AI, rational agent approaches to AI, introduction to intelligent agents, their structure, behavior and task environment.	10
II	Problem Solving and Searching Techniques: Problem characteristics, production systems, control strategies, breadth-first search, depth-first search, hill climbing and its variations, heuristics search techniques: best-first search, A* algorithm, constraint satisfaction problem, means-end analysis, introduction to game playing, min-max and alpha-beta pruning algorithms.	16
III	Knowledge Representation: Propositional logic, First-Order Predicate logic, resolution principle, unification, semantic nets, conceptual dependencies, frames, and scripts, production rules, Introduction to Programming in Logic (PROLOG).	12
IV	Understanding Natural Languages: Components and steps of communication, the contrast between formal and natural languages in the context of grammar, Chomsky hierarchy of grammars, parsing, and semantics, Parsing Techniques, Context-Free and Transformational Grammars, Recursive and Augmented transition nets.	12
V	AI The Present and the Future: Symbolic AI, Data-driven AI and Machine Learning, Introduction to Machine Learning and Deep Learning based AI, some applications of symbolic and data driven AI, Interpretable and Explainable AI, Ethics of AI: benefits and risks of AI.	10

Suggested Books:

1. Russell, Stuart, J. and Norvig, Peter, Artificial Intelligence - A Modern Approach, Pearson, 4th edition, 2020..
2. Bratko, Ivan, Prolog Programming for Artificial Intelligence, Addison-Wesley, Pearson Education, 4th edition, 2012.
3. Patterson, DAN,W, Introduction to A.I. and Expert Systems – PHI, 2007.
4. Clocksin, W., F. and Mellish, Programming in PROLOG, 5th edition, Springer, 2003.
5. Kaushik, Saroj, Artificial Intelligence, Cengage Learning India, 2011.
6. Rich, Elaine and Knight, Kelvin, Artificial Intelligence, 3rd edition, Tata McGraw Hill, 2010

Year- III Semester- VI

Course Name: Software Engineering

Course Objective(s): The course provides a professionally guided education in software engineering that helps students to transition into an amateur software engineer by exposing themselves to a broad perspective on software systems engineering, concentrating on widely used techniques for developing large-scale software systems. This course covers a wide spectrum of software processes from initial requirements elicitation through design and development to system evolution

Course Outcomes COs :

CO1 Learn to apply the knowledge of software engineering methodologies to identify, formulate, and solve software engineering problems.

CO2 Understand the ability to analyze the complex system by applying analytical, engineering and knowledge based techniques to clearly understand the requirements.

CO3 An ability to design a system, component, or process to meet desired needs within realistic constraints relevant to the system.

CO4 An ability to implement, verify, validate, test and maintain software systems developed using modern techniques, skills and engineering tools.

CO5 An ability to function on multi-disciplinary teams with an understanding of professional and ethical responsibility to create solutions for significant application domains.

Course Name: Software Engineering			
Course Code: 0690402	**Marks IE/EE: 25/75**	**Max. Marks(IE+EE): 100**	
Credits: 4	**Core Compulsory**	**Passing Marks: 33**	
Unit	**Details**		**Lecture Hours**
I	Software Engineering Concepts - A Generic view of Process - Categories of Software - Process Models - Waterfall model - Incremental - Evolutionary - Prototyping – Spiral – Concurrent – RAD - Specialized models - Unified Process Models. - Agile Models.		12
II	Requirements Engineering: Tasks Initiation - Elicitation - Developing Use Cases - Building the analysis model - Use Case Modelling - Negotiation - Validation.		12
III	Building the Analysis Model: Approaches - Data modelling concepts - Flow Oriented Modelling - Behavioural Modelling – State transition diagram – Sequential Diagram. Data Dictionary.		12
IV	Design Engineering: Design characteristics, Design Process and Quality - Design Concept - Creating an Architectural Design - Software Architecture - Data Design - Architectural Styles and Patterns - Architectural Design - Mapping Data Flow into Software Architecture - Object oriented Design - Agile definition roles in agile, principles of agile manifesto, agile principles, agile characteristics, agile iteration planning. Release planning in agile.		12
V	Software Testing Fundamentals - Objectives of Testing - Testing Principles – Testability -Testing Process and Methods – Testing Strategies - Testing Tactics. - White Box - Black Box testing - Debugging process.		12

Suggested Books:

1. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", Tata McGraw- Hill Publishing Company Pvt. Ltd, Seventh Edition.
2. Ian Somerville, "Software Engineering", 10th Edition, Pearson Publication, 10th edition, 2015.
3. Shooman, "Software Engineering", Tata McGraw-Hill Publishing Company, Pvt. Ltd, 1987

Year- III Semester- VI

Course Name: Computer Networks

Course Objective(s) : This course studies the standard models for the layered approach to communication between autonomous machines in a network, and the main characteristics of data transmission across various physical link types. It considers how to design networks and protocols for diverse situations, analyses several protocols, and identifies significant problem areas in networked communications.

Course Outcome COs:

CO1: Explain the basic network concepts, including the structure and operation of the different types of networks

CO2: Must be able to understand the design of different networks and related reference modelsused

CO3: Comprehend the basic working principles behind switching techniques used in communication channels.

CO4: Familiarize the routing techniques and congestion control mechanisms used in Routers. Must be able to understand and successfully apply routing algorithms for optimization.

CO5: Must be able to understand, how is the end-to-end connection mechanism works at the transport layer.

Course Name: Computer Networks		
Course Code: 0690403	**Marks IE/EE: 25/75**	**Max. Marks(IE+EE): 100**
Credits: 4	**Core Compulsory**	**Passing Marks: 33**

Unit	**Details**	**Lecture Hours**
I	Introduction To Computer Networks: Introduction: Definition of a Computer Network; Components of a computer network; Classification of networks; Transmission Medium; Wireless transmission; Local area networks, Metropolitan area networks, Wide area networks, Wireless networks ; Data transmission modes.	12
II	Layered Architecture: Network Software & Network Standardization: Networks Software; Protocol hierarchy, Design issues for the layers, Merits and De-merits of Layered Architecture, Reference models; The OSI Reference Model, The TCP/IP Reference Model, Comparison of the OSI & the TCP/IP Reference Models	12
III	Physical Layer: Network topologies; Switching; Circuit switching, Message switching, Packet switching, Relationship between Packet Size and Transmission time, Comparison of switching techniques: Multiplexing; FDM, WDM, TDM	12
IV	Network Layer: Design issues of Network layer; Nature of the service provided, Routing, Congestion control, Types of routing algorithms, Classes of routing algorithms, Properties of routing algorithms, Optimality principle: Routing algorithms; Shortest path algorithm, Flooding, Distance vector routing, Hierarchical routing, Link state routing, Factors of congestion, Comparison of flow control and congestion control, General principles of congestion control	12
V	Transport Layer: Services of Transport layer; Service primitives: Connection establishment: Connection Release: Transport Protocols;	12

Suggested Books:

1. Computer Networks, 4th Edition, Andrew S. Tanenbaum.
2. Computer Networks: A Top-Down approach, Behrouz A Forouzan, Firouz Mosharraf, McGraw Hill Education.
3. Computer Networking: A Top-Down Approach, 6th Edn, Kurose James F., Keith W Ross, Pearson publications.

Year- III Semester- VI

Course Name: Machine Learning

Course Objective(s): To understand the fundamentals of machine learning and its applications., To familiarize with the popular ML algorithms used to solve real world problems.

Course Outcomes COs

CO1 Able to categorize the problems as supervised or unsupervised and to apply regression algorithm for prediction problems.

CO2 Select and apply supervised algorithms like Naïve bayes algorithm, decision tree and analyze the models using different evaluation parameter.

CO3 To build ML models using KNN, SVM classifiers and to perform feature engineering and selection using PCA and LDA.

CO4 To Apply different clustering algorithms for the unlabeled data and interpret the results.

CO5 Understand the fundamental concepts of deep learning.

Course Name: Machine Learning		
Course Code: 0690404	**Marks IE/EE: 25/75**	**Max. Marks(IE+EE): 100**
Credits: 4	**Core Compulsory**	**Passing Marks: 33**

Unit	Details	Lecture Hours
I	Introduction to ML, Goals and applications of machine learning. Aspects of developing a learning system: training and testing data. Types of learning: Supervised, Unsupervised, and Reinforcement. Linear regression, variance, bias, gradient descent, R2, Ridge and Lasso regression.	12
II	Logistic regression, decision boundary, classification parameters: Accuracy, precision, recall, F-measure, RoC curve. Bayesian learning: Probability theory and Bayes rule. Naive Bayes learning algorithm. Regression tree –random forest	12
III	Perceptron and back-propagation neural network - k-nearest neighbour rule. Support vector machine: multi-category generalizations, Kernels for learning non-linear functions. ADA Boost classifier. Feature engineering and feature selection. PCA and LDA	12
IV	Unsupervised learning. Clustering: Learning from unclassified data. Clustering. Hierarchical Agglomerative Clustering. k-means partitional clustering. Expectation maximization (EM) for soft clustering. Semi-supervised learning with EM using labeled and unlabled data.	12
V	Deep learning: Deep Neural network, Activation functions, Cost function, feed forward network, CNN, Sequential Models.	12

Suggested Books:

1. Kevin P. Murphey, "Machine Learning, a probabilistic perspective", The MIT Press, 2012.
2. Tom Mitchael, "Machine Learning", McGraw Hill, 1997.
3. EthemAlpaydin,"Introduction to Machine learning", PHI learning, MIT Press, 2010, 2nd edition
4. John D. Killeher, Brian Mac, Namee, AoiFE D'Arcy, Fundamental of Machine Learning for Predictive Data Analytics, 2015 MITpress.
5. Alex Smola and SVN. Viswanathan, "Introduction to Machine Learning", Cambridge University Press, 2008.
6. ShaiShalev-Shwartz and Shai Ben-David, "Understanding Machine Learning: From Theory to Algorithms", Cambridge University Press,2014.
7. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.