Deccan Education Society's
Fergusson College (Autonomous), Pune-4
Department of COMPUTER SCIENCE

Syllabi NEP 1.0 Implemented from Academic Year 2025-26
T.Y. BSc Computer Science Semester: V

Program Specific Outcomes (PSOs)

PSO	Outcomes
PSO1	**Academic Competence:** (i) Understand various concepts of Computing, Statistics, Mathematics and Electronics appropriately to the discipline. (ii) Recommend computing solutions to solve the problems in different domains.
PSO2	**Personal and Professional Competence:** (i) Apply the fundamental knowledge for professional software development as well as to acquire new skills. (ii) Develop strong problem solving, analyzing and decision-making abilities. Identify the information and apply their disciplinary knowledge and professional skills to design components, system or processes to meet required specification.
PSO3	**Research Competence:** (i) Apply programming languages, tools and techniques to conduct research and demonstrate appropriate emerging skills to seek solutions to problems in various interdisciplinary fields. (ii) Integrate Computer Science, Electronics, Mathematical and Statistical knowledge to explore different domains' data for experimental and research purpose.
PSO4	**Entrepreneurial and Social Competence:** (i) Use the knowledge and skills necessary to support their career in software development, web development, databases and entrepreneurship in recent trends like data analytics, artificial intelligence, Image processing, Networking, Embedded systems etc. (ii) Develop software based solutions for industry as well as research and development and develop skills required for social interaction.

T. Y. B. Sc. Computer Science NEP 1.0						
Semester	Paper	Paper Code	Title	Type	Credits	Exam Type
V	Major	CSC-301	Operating System-I	Theory	2	CE+ESE
		CSC-302	Java Programming-I	Theory	2	CE+ESE
		CSC-303	Computer Networks-I	Theory	2	CE+ESE
	Elective	CSC-304 OR CSC-305	Theoretical Computer Science OR Software Project Management-I	Theory	2	CE+ESE
				Theory	2	CE+ESE
		CSC-306 OR CSC-307	Foundation of Data Science OR Computer Graphics-I	Theory	2	CE+ESE
	Major	CSC-311	Computer Science Practical-5	Practical	2	CE+ESE
		CSC-312	Computer Science Practical-6	Practical	2	CE+ESE
	VSC	CSC-331	Server-side Programming (PHP)	Theory	2	CE
		CSC-332	Computer Science Practical-7 (Project-1)	Practical	2	CE
	Minor	MTS-323	Calculus and Applications	Theory	2	CE+ESE
		OR				
		ELS-322	Wireless Communication			
		OR				
		STS-322	Statistical Methods-III			
	FP	CSC-345	Field Project	Theory / Practical	2	CE
VI	Major	CSC-351	Operating System-II	Theory	2	CE+ESE
		CSC-352	Java Programming-II	Theory	2	CE+ESE
		CSC-353	Computer Networks-II	Theory	2	CE+ESE
	Elective	CSC-354 OR CSC-355	Compiler Construction OR Software Project Management-II	Theory	2	CE+ESE
				Theory	2	CE+ESE
		CSC-356 OR CSC-357	Introduction to Data Analytics OR Computer Graphics-II	Theory	2	CE+ESE
				Theory	2	CE+ESE
	Major	CSC-361	Computer Science Practical-8	Practical	2	CE+ESE
		CSC-362	Computer Science Practical-9	Practical	2	CE+ESE
	VSC	CSC-382	Computer Science Practical-10 (Project-2)	Practical	2	CE
	Minor	MTS-373	Operations Research	Theory	2	CE+ESE
		OR				
		ELS-372	IoT Applications			
		OR				
		STS-372	Statistical Methods-IV			
	OJT	CSC-395	OJT	Theory / Practical	4	CE

	CSC-301 - Operating System-I **Major-Theory**	
	Number of Credits: 02 **No. of Hours:30**	
Course Outcomes (COs) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	List the elements of the programming environment. Differentiate system programming and application programming.	1
CO2	Transform the algorithms into code to implement the various system programs	2
CO3	Apply the knowledge of process concept and Linux system calls to implement a command interface (Shell).	3
CO4	Explain various system services and its examples, system calls and its types.	4
CO5	Compare computer system architectures, discuss operating system operations.	5
CO6	Write assembly programs and explain the process of translation, execution	6

CSC-301 - Operating System- I
(Major - Theory)

Unit No.	Title of Unit and Contents	No. of hours
1	**Introduction** 1.1 Types of program - System program and Application program 1.2 Difference between system programming and application programming 1.3 Elements of programming environment - Editor, Preprocessor, Assembler, Compiler, Interpreter, Linker and Loader, Debugger, Device drivers, Operating System	**03**
2	**Assembler** 2.1 Elements of Assembly Language Programming 2.2 Simulation of simple computer smaco (hypothetical computer) – Memory, Registers, Condition Codes, Instruction format, Instruction Set, smacoprogram 2.3 smaco programs- Translation and Execution 2.4 A simple Assembly scheme 2.5 Pass structure of Assemblers 2.6 Design of Two-pass Assembler, Macro Assembler	**12**
3	**Linker and Loader** 3.1 Introduction, Concept of binding - static and dynamic 3.2 Concept of addresses - translated, linked and load time addresses 3.3 Relocation and linking concept – program relocation, performing relocation, public and external references, linking, binary program, object module 3.4 Types of Loaders – compile- and-go, absolute, relocating and direct-linking	**04**

	3.5 Relocatability non relocatable, relocatable, and self-relocating programs, Linking for Overlays	
4	**Operating System as System Software** 4.1 What Operating Systems Do – User View, System View 4.2 Defining OS, Computer System Architecture – Single processor system, Multiprocessor systems, Clustered Systems 4.3 Operating System Operations – Dual mode operation, Privilege, Instruction, Timer 4.4 Process Management, Memory Management 4.5 Storage Management – File system management, Mass storage management, Caching, I/O systems Protection and Security , Distributed Systems, System Boot	**04**
5	**System Structure** 5.1 Operating System Services 5.2 User Operating-System Interface – Command interpreter, GUI 5.3 System Calls, Types of System Calls – Process control, File management, Device management, Information maintenance, Communication, Protection 5.4 Linux System calls – file and directory management	**04**
6	**Process Concept** 6.1 Process concept- Process, Process State, PCB, Process scheduling 6.2 Operations on processes 6.3 Linux System calls – process.	**03**

Learning Resources- References

Sr. No.	References
1.	D. M. Dhamdhere, Systems Programming and Operating Systems, 2nd Revised Edition, 2011
2.	Silbertchatz, Galvin, Gagne, Operating System Concepts - Willey Publication (8th Edition),2011
3.	John R. Levine, Elsevier Moegan Kaufmann, Linkers and Loaders, 2000
4.	Leland L. Beck, System Software - An introduction to Systems Programming, Pearson Education, 1997
5.	John J. Donovan, Systems Programming, McGraw Hill Education, 1991

	CSC-302 - Java Programming-I **Major-Theory**	
	Number of Credits: 02 **No. of Hours:30**	
Course Outcomes (COs) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	List the basics of object-oriented programming	1
CO2	Illustrate the strong features of Java.	2
CO3	Implement file handling using different classes	3
CO4	Classify different types of inheritance and exceptions.	4
CO5	Compare different Java libraries.	5
CO6	Design GUI based applications using swing.	6

CSC-302 - Java Programming-I
(Major - Theory)

Unit No.	Title of Unit and Contents	No. of hours
1	**Fundamentals of Java Programming** 1.1 Introduction to Object Oriented Programming, 1.2 Basic Concepts of Object-Oriented Programming, History of Java, features of java 1.3 Java Tools – jdb, javap, javadoc, javah, appletviewer, Simple Java program 1.4 Structure of Java program 1.5 Arrays and its application, accepting input using command line arguments 1.6 Simple programs using, Conditional Statement (if – else, Switch, Loops (while, do-while, for, for-each)	**03**
2	**Objects and Classes** 2.1 Defining Classes, Access Specifiers (public, protected, private, default), 2.2 Array of Objects, Constructor, Overloading Constructors and use of 'this' Keyword ,Static block, static Fields and methods, Predefined class – Object 2.3 class methods(equals (), toString(), getClass()), 2.4 Creating, Accessing and using Packages, Wrapper Classes	**03**
3	**Inheritance and Interface** 3.1 Inheritance Basics (extends Keyword) and Types of Inheritance, Super class, Subclass and use of Super Keyword Method Overriding and runtime polymorphism 3.2 Use of final keyword related to method and class, Use of abstract class and abstract methods 3.3 Interfaces, Defining and Implementing Interfaces 3.4 Runtime polymorphism using interface	**06**

4	**Exception Handling** 4.1 Dealing Errors, Exception class 4.2 Checked and Unchecked exception, Catching exception and exception handling 4.3 Creating user defined exceptions	**03**
5	**Strings, Streams and Files** 5.1 String class and String Buffer Class 5.2 Using the File class Stream classes, Byte Stream classes, Character Stream Classes, Creation of files 5.3 Reading/Writing characters and bytes 5.4 Handling primitive data types	**06**
6	**User Interface Components and Event Handling – Swing** 6.1 What is Swing? The MVC Architecture and Swing 6.2 Layout Manager and Layouts 6.3 The JComponent class, Components –JButton, JLabel, JText, JTextArea, JCheckBox and JRadioButton, JList, JComboBox, JMenu and JPopupMenu, JMenuItem and JCheckBoxMenuItem, JRadioButtonMenuItem, JScrollBar 6.4 Dialogs (Message, confirmation, input), JFileChooser, JColorChooser 6.5 Event Handling: Event sources, Listeners, Mouse and Keyboard Event Handling, Adapters	**09**

Learning Resources- References

Sr. No.	References
1.	Herbert Schildt, Java: The Complete Reference 12th Edition McGraw-Hill
2.	E. Balagurusamy, Programming with java 7th Edition McGraw-Hill
3.	https://www.javatpoint.com/java-tutorial

	CSC-303 - Computer Network-I **Major-Theory**	
	Number of Credits: 02 **No. of Hours:30**	
Course Outcomes (COs) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Define basic concepts of computer networks.	1
CO2	Explain networking models and addressing schemes	2
CO3	Apply the topologies, encoding schemes and addressing methods as per given network environments.	3
CO4	Analyze the working of various layers of network models.	4
CO5	Compare various topologies, networking types and protocols.	5
CO6	Integrate the concepts of computer networking to design set up of network environments	6

CSC-303 - Computer Network-I
(Major - Theory)

Unit No.	Title of Unit and Contents	No. of hours
1	**Introduction to Computer Network** 1.1 Data Communication - Definition, components, data representation, Data Flow, Key elements of protocol, Standards, Standards organizations 1.2 Network Hardware - Broadcast and point-to-point 1.3 Network Types-LAN, MAN, WAN, Wireless Networks, Home Networks, Internetwork 1.4 Topologies - bus, star, ring, mesh, hybrid 1.5 Design issues of the layers - addressing, error control, flow control, multiplexing and de-multiplexing, routing, Connection-oriented and connectionless service	**06**
2	**Network Models** 2.1 OSI Reference Model - Functionality of each layer 2.2 TCP/IP Reference Model - Functionality of each layer 2.3 Comparison of OSI and TCP / IP Model 2.4 Addressing - Physical, Logical and Port addresses	**03**
3	**The Physical Layer** 3.1 Transmission impairment - Attenuation, Distortion and Noise 3.2 Line Coding Characteristics, Line Coding Schemes – Unipolar-NRZ, Polar-NRZ-I, NRZ-L, RZ, Manchester and Differential Manchester, AMI, HDB3, B8ZS 3.3 Switching - Circuit Switching, Message Switching and Packet Switching 3.4 Comparison of circuit & packet switching 3.5 Application of switching - Telephone and mobile network 3.6 Physical Layer Device - Repeater	**06**
4	**The Data Link Layer** 4.1 Design Issues - Services provided to the Network Layer 4.2 Framing - Concept, methods – Character Count, Flag bytes with Byte Stuffing, Starting & ending Flags with Bit Stuffing and Physical Layer Coding Violations, Error Control, Flow Control	**06**

	4.3 Data Link Layer Protocols –Noiseless channel -A Simplex, Stop-And-Wait protocol, Noisy channel –stop & wait, ARR, Pipelining, Go –back–N, ARR & ARQ, Concept of sliding window, selective repeat ARR 4.4 Piggybacking-Need, Advantages / Disadvantages 4.5 Data Link Layer Device – Bridge	
5	**Multiple Access** 5.1 Random Access Protocols ALOHA - pure and slotted Controlled Access Protocol - Reservation, Polling and Token Passing	**03**
6	**Network Layer** 6.1 Design Issues of network layer - Store and forward packet switching, services provided to transport layer, Implementation of connectionless and connection oriented services, comparison of virtual circuit and datagram 6.2 Logical Addressing - IPV4, addresses, Address space, Notations, Classfull addressing, Classless addresses 6.3 IPV4 Datagram format 6.4 Network layer device - Router, Router table 6.5 Network address translation	**06**

Learning Resources- References

Sr. No.	References
1.	Behrouz A. Forouzan :Data Communication and Networking Fourth Edition, TATA McGrawHilL

	CSC-304 - Theoretical Computer Science Elective-Theory	
	Number of Credits: 02 No. of Hours:30	
Course Outcomes (COs) On completion of the course, the students will be able to:		**Bloom's cognitive level**
CO1	Define the basic concepts of Automata Theory and describe various forms of grammar to know functioning, capabilities and limitations of computers.	1
CO2	Explain and construct finite state systems and Context Free Grammar for the given language. Construct regular expressions to recognize patterns and PDA, Turing machine to recognize various computing languages or problems.	2
CO3	Apply various techniques and algorithms to transform computing models and grammar.	3
CO4	Analyze and simplify CFG, classify various grammars according to the Chomsky hierarchy.	4
CO5	Test and evaluate various classes of problems, grammar, languages and language recognizer machines	5
CO6	Integrate the concepts of finite automata, regular expression and context free grammar to create a LEX and YAAC programs. Create regular expressions for regular languages to recognize patterns.	6

CSC-304 - Theoretical Computer Science
(Elective-Theory)

Unit No.	Title of Unit and Contents	No. of hours
1	**Finite Automaton** 1.1 Introduction: Symbol, alphabet, string, prefix and suffix of strings, formal languages, operations on languages. 1.2 Deterministic Finite Automaton-Definition, examples of DFA as language and pattern recognizers. 1.3 Non Deterministic Finite Automaton-Definition and examples. 1.4 Conversion of NFA to DFA. 1.5 NFA with ε-Transitions –Definition and examples. 1.6 Conversion of NFA with ε-Transitions to DFA. 1.7 Finite Automaton with Output- Mealy and Moore machine, Definition and examples. 1.8 Minimization of DFA using Table method.	**10**
2	**Regular Expressions and Languages** 2.1 Regular Expression (RE): Definition and Examples. 2.2 Identities and Regular Language Definition, examples. 2.3 Conversion of RE to FA. 2.4 Closure properties of Regular Languages. 2.5 Pumping lemma for regular languages and applications.	**04**

3	**Context-Free Grammars and Languages** 3.1 Definition of Grammar and examples. 3.2 Derivation-Reduction-Definition and Examples. 3.3 Chomsky Hierarchy. 3.4 CFG: Definition & Examples. 3.5 LMD, RMD, Parse Tree, Ambiguous Grammar. 3.6 Simplification of CFG: Removing Useless Symbols, 3.7 Unit Production, ϵ-production and Nullable symbols 3.8 Normal Forms: Greibach Normal Form (GNF) and Chomsky Normal (CNF) 3.9 Equivalence of FA & Regular Grammar 3.10 Construction of regular grammar equivalent to a given DFA. 3.11 Construction of a FA from the regular grammar	**08**
4	**Push Down Automata** 4.1 Push Down Automata (PDA): Definition and examples. 4.2 Construction of PDA using empty stack and final state method. 4.3 Definition of DPDA & NPDA, their correlation and examples of NPDA	**04**
5	**Turing Machine** 5.1 Turing Machine Model: Definition and Design of TM 5.2 Problems on Language recognizers 5.3 Languages accepted by Turing Machine. 5.4 Introduction: LBA	**04**

Learning Resources- References

Sr. No.	References
1.	Introduction to Automata Theory, Languages and Computation, John E. Hopcraft, Rajeev Motwani, Jeffrey D. Ullman, Third Edition, Pearson Education Publication, 2008
2.	Introduction to Automata theory, Languages and computation By John E. Hopcroft and JeffreyUllman – Narosa Publishing House, 1995
3.	Theory of Computer Science Automata, Languages and Computation, K.L.P. Mishra, N. Chandrasekaran, Publication- Prentice Hall of India, 2008
4.	Introduction to Computer Theory Daniel I. A. Cohen – 2nd edition – John Wiley & Sons, 1996
5.	Introduction to Languages and The Theory of Computation John C. Martin The McGraw-Hill, Fourth Edition, 2011

	CSC-305 - Software Project Management-I **Elective-Theory**	
	Number of Credits: 02 **No. of Hours:30**	
Course Outcomes (COs) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Identify key characteristics of software projects.	1
CO2	Assess software scope and conduct feasibility analyses	2
CO3	Proficiently apply scope, time and cost estimation techniques.	3
CO4	Perform software verification and validation using inspections, design and execution of system test cases	4
CO5	Implement formal technical strategies with time management	5
CO6	Create detailed Software Project Management (SPM) plans. Include resource identification and allocation strategies for effective project planning.	6

CSC-305 - Software Project Management-I
(Elective - Theory)

Unit No.	Title of Unit and Contents	No. of hours
1	**Introduction to Project Management** 1.1 What is a Project? 1.2 What is Project management? 1.3 Project phases 1.4. Project Life Cycle 1.5 Organizational structure 1.6 Qualities of Project Manager 1.7 Work Breakdown Structure (WBS)	**06**
2	**Project Management Components** 2.1 Project Integration Management 2.2 Project plan development 2.3 Project execution 2.4 Change controls 2.5 CCB Configuration management	**08**
3	**Scope Management** 3.1 Strategic planning 3.2 Scope planning, definition 3.3 Scope Verification and Scope control 3.4 Function Point and LOC	**08**
4	**Time Management** 4.1 Activity planning 4.2 Schedule development and control 4.3 GANTT Chart 4.4 Activity Networks 4.5 PERT/CPM Networks	**08**

Learning Resources- References

Sr. No.	References
1.	Kathy Schwalbe, Project Management in IT, CENGAGE Learning, (2007)
2.	Roger Pressman, Software Engineering McGraw-Hill
3.	Robert B. Grady, Software Metrics for Project Management and process improvement, Prentice hill
4.	Pankaj Jalote, Software Project Management in Practice, Pearson Education Asia (2002).
5.	Bob Hughes and Mike Cotterell, Software Project Management, Tata McGraw Hill Publishing Company Ltd., New Delhi (2006) 3rd edition.
6.	Roger Pressman, A practitioner's Guide to Software Engineering, Tata McGraw Hill (2004).
7.	Tom Demarco, Controlling Software Project Management, Measurement, Prentice Hall, New Jersey (1982).
8.	Watts S. Humphrey, Winning with Software an Executive Strategy, Pearson Education Asia (1998).
9.	Philip Metzger, Managing A Programming Project, Prentice Hall, New Jersey (1983).
10.	https://www.javatpoint.com/

	CSC-306 - Foundation of Data Science Elective-Theory	
	Number of Credits: 02 No. of Hours:30	
Course Outcomes (COs) On completion of the course, the students will be able to:		**Bloom's cognitive level**
CO1	Discuss various applications of data science.	1
CO2	Describe data models and CRISP-DM.	2
CO3	Calculate statistical measures for the given dataset.	3
CO4	Identify methods for data preprocessing, analyze the data and apply to various datasets.	4
CO5	Determine the data visualization method to represent the data.	5
CO6	Collect data, apply data preprocessing, and visualize the data for the given case study.	6

CSC-306 - Foundation of Data Science
(Elective - Theory)

Unit No.	Title of Unit and Contents	No. of hours
1	**Introduction** 1.1 Essential of data 1.2 What is Data Analysis? 1.3 Applications of Data Science	**02**
2	**Frameworks of Data Science** 2.1 Data Models 2.2 CRISP-DM Methodology	**03**
3	**Essentials of Statistical Learning** 3.1 Basics of Statistics: mean, median, standard deviation, variance, correlation, covariance 3.2 Introduction to Regression	**07**
4	**Data Pre-processing** 4.1 Data collection 4.2 Why Pre-processing? 4.3 Methods of pre-processing 4.4 Data Cleaning 4.4.1 Data Integration 4.4.2 Data Reduction: Attribute subset selection, Histograms, Clustering and Sampling 4.4.3 Data Transformation & Data Discretization: Normalization, Binning, Histogram Analysis	**08**
5	**Data Visualization** 5.1 Data Representation 5.2 Data Exploration 5.3 Plotting the data 5.4 Types of graphs 5.4.1 Histogram 5.4.2 Scatterplot 5.4.3 Bar plot 5.4.4 Box plot	**08**

	Working with interactive charts	
6	**Case Study**	**02**

Learning Resources- References

Sr. No.	References
1.	Bill Lubanovic, "Introducing Python- Modern Computing in Simple Packages", O' Reilly Publication, 2014
2.	C R Kothari, Quantitative Techniques, 3rd revised Edition, 2013
3.	The R Book Michel J. Crawley Second Edition, Wiley publication, December 2012
4.	Ronald E Walpole, Sharon L Myres, Keying Ye, Probability and Statistics for Engineers and Scientist, 8th Edition, Pearson, 2007
5.	www.analyticsvidya.com
6.	www.udemy.com
7.	https://towardsdatascience.com/machine-learning/home
8.	http://epgp.inflibnet.ac.in/

	CSC-307-Computer Graphics-I **Elective-Theory**	
	Number of Credits: 02 **No. of Hours:30**	
Course Outcomes (COs) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Describe different graphic concepts	1
CO2	Illustrate the graphics functions.	2
CO3	Apply algorithms of Simple Line drawing.	3
CO4	Explain different algorithms of line drawing.	4
CO5	Determine the appropriate use of transformation	5
CO6	Design the code for basic transformation of two dimension.	6

CSC-307 - Computer Graphics-I
(Elective- Theory)

Unit No.	Title of Unit and Contents	No. of hours
1	**Basics Of Computer Graphics** 1.1 Introduction 1.2 What is computer Graphics? 1.3 Area of Computer Graphics - 1.3.1 Design and Drawing 1.3.2 Animation 1.3.3 Multimedia applications 1.3.4 Simulation 1.4 How are pictures actually stored and displayed 1.5 Difficulties for displaying pictures 1.6 Block Summary	**04**
2	**Graphic Devices And Graphic Functions** 2.1 Introduction 2.2 Cathode Ray Tube, Quality of Phosphors 2.3 CRTs for Color Display, Beam Penetration CRT 2.4 The Shadow - Mask CRT 2.5 Direct View Storage Tube 2.6 Tablets, The light Pen 2.7 Three Dimensional Devices 2.8 Graphics Functions	**06**
3	**Simple Line Drawing Methods** 3.1 Introduction 3.2 Point Plotting Techniques 3.3 Qualities of good line drawing algorithms 3.5 The Digital Differential Analyzer (DDA) 3.6 Bresenham's Algorithm 3.7 Generation of Circle	**10**
4	**Two Dimensional Transformations** 4.1 Introduction 4.2 What is transformation? 4.3 Matrix representation of points 4.4 Basic transformation 4.5 Translation 4.6 Rotation	**10**

Learning Resources- References

Sr. No.	References
1.	Hearn/Baker**, "**Computer Graphics with OpenGL, 4e**",** Pearson Education India, Fourth Edition**, 2013.**
2.	Atul Godse , "Computer Graphics", Technical Publications, 2021.
3.	https://www.geeksforgeeks.org/introduction-to-computer-graphics/
4.	https://www.javatpoint.com

	CSC-311 - Computer Science Practical-5 **Major-Practical**	
	Number of Credits: 02 **No. of Hours:60**	
Course Outcomes (COs) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	List the errors and warnings in an assembly program	1
CO2	Explain and demonstrate the process of assembly program translation, execution, command line-interpreter (extended shell).	2
CO3	Apply different system calls for process creation, execution and its termination	3
CO4	Identify and design various data structures and represent it in tabular format	4
CO5	Validate the input and execute the programs with test inputs.	5
CO6	Write modularized program code for implementing various System programs and integrate them	6

CSC-311 - Computer Science Practical-5
(Major-Practical)

Sr. No.	**Title of Experiment / Practical**
1.	Basic practice on Linear Data Structures
2.	Basic practice on Non-Linear Data Structures
3.	Assembler 1
4.	Assembler 2
5.	Assembler 3
6.	Assembler 4
7.	Simulator
8.	Process creation
9.	Handling shell 1
10.	Handling shell 2
11.	Handling shell 3
12.	Handling shell 4
13	Experimental Activity on Computer Network
14	Student Activity 1
15	Student Activity 2

	CSC-312 - Computer Science Practical-6 **Major-Practical**	
	Number of Credits: 02 **No. of Hours:60**	
Course Outcomes (COs) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	List different programming concepts to understand the designing of simple program. Explain the importance of Object-oriented application design	1
CO2	Classify exceptions to handle run time errors and build the user defined exceptions	2
CO3	Implement the concept of interface and packages for real time application	3
CO4	Organize the information using file handling.	4
CO5	Determine the appropriate component and event for GUI.	5
CO6	Develop user friendly applications based on MVC architecture.	6

CSC-312 - Computer Science Practical-6
(Major-Practical)

Sr. No.	Title of Experiment / Practical
1.	Basics of Java
2.	Creating Objects and Classes
3.	Use of Packages
4.	Inheritance -1
5.	Inheritance -2
6.	Abstract Class and Interface
7.	Exception Handling
8.	User Defined Exception Handling
9.	Strings and Streams
10.	File Handling
11.	Simple GUI Designing
12.	GUI designing using various controls
13.	GUI Designing with Event Handling
14.	Student Activity-1
15.	Student Activity-2

	CSC-331 - Server-side Programming (PHP) VSC-Theory	
	Number of Credits: 02 No. of Hours:30	
Course Outcomes (COs) On completion of the course, the students will be able to:		**Bloom's cognitive level**
CO1	Describe the HTML form processing in PHP	1
CO2	Illustrate the use of functions in PHP.	2
CO3	Apply regular expressions and string functions	3
CO4	Explain DML statements to be connected with PHP	4
CO5	Determine the appropriate use of array related library functions	5
CO6	Design the code for developing database connectivity to create a website	6

CSC-331 - Server-side Programming (PHP)
(VSC - Theory)

Unit No.	Title of Unit and Contents	No. of hours
1	**Server-Side Scripting Using PHP** 1.1 Introduction 1.2 Language Basics: variables, data types, operators 1.3 constants, decisions structure 1.4 loop making decisions 1.5 Functions in PHP 1.6 include and require statements 1.7 Form processing	**08**
2	**Strings and Array in PHP** 2.1 Creating and accessing String 2.2 Printing functions 2.3 String related library functions 2.4 Regular Expressions 2.5 Creating arrays – Index and Associative 2.6 Array related library functions 2.7 Multidimensional array	**10**
3	**Database Connectivity with PostgreSQL** 3.1 Connection with PostgreSQL Database 3.2 Performing basic database operation (DML) – Insert 3.3 Select query, select with where clause 3.4 Fetching methods 3.4 Delete query 3.5 Setting query parameter 3.6 Executing query 3.7 Mini Project as case study	**12**

Learning Resources- References

Sr. No.	References
1.	Matt Doyle, "Beginning PHP 5.3", Wrox Publication, 2010
2.	David Sklar & Adam Trachtenberg, "PHP cookbook", O'Reilly Publication, 2010
3.	Ivan Bayross & Sharanam Shah, "PHP 5.1 for Beginners", SPD Shroff Publishers & Distributers Pvt. Ltd., 2006
4.	Rasmus Lerdorf and Kevin Tatroe, "Programming PHP", O'Reilly publication, 2002
5.	https://www.W3schools.com
6.	https://www.php.net.in

	CSC-332 - Computer Science Practical-7 (Project-1) **VSC-Practical**	
	Number of Credits: 02 **No. of Hours: 30**	
Course Outcomes (COs) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Define system scope and description.	1
CO2	Outline the data and functional requirements.	2
CO3	Demonstrate ER-Modelling.	3
CO4	Construct Class Diagram.	4
CO5	Select the technology for project.	5
CO6	Build the input / output screen.	6

CSC-332 - Computer Science Practical-7 (Project-1)
(VSC - Practical)

Sr. No.	Title of Experiment / Practical
1.	Problem definition
2.	Feasibility study with Technical Requirements
3.	Gathering Data Requirement and Functional Requirement
4.	Entity Relationship diagram or Flowchart (For Non-Database Projects)
5.	Designing the Normalized Database
6.	Database Creation (using SQL)
7.	Use Case Diagram
8.	Input/output Screens
9.	Class Diagram
10.	Coding and Implementation of Input/Output screen
11.	Project Demo -1
12.	Final Demo

	MTS-323-Calculus and Applications **Minor-Theory**	
	Number of Credits: 02 **No. of Hours:30**	
Course Outcomes (COs) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Understanding Fundamental Calculus Concepts	1
CO2	Explain key calculus concepts such as limits, derivatives, integrals, and continuity.	2
CO3	Compute derivatives of elementary functions and apply these concepts in real-world problems such as optimization.	3
CO4	Explain concepts like Curl, Gradient and divergence.	4
CO5	Evaluate maxima and minima of multi variable functions.	5
CO6	Develop Skills to interpret and create graphs of functions, analyse trends and make predictions based on calculus principles.	6

MTS-323 - Calculus and Applications
(Minor - Theory)

Unit No.	Title of Unit and Contents	No. of hours
1	**Differentiation and Applications** 1.1 Definition of a derivative 1.2 Mean Value Theorem 1.3 Increasing and decreasing functions, concavity 1.4 First and second derivative tests for local extrema	**07**
2	**Functions of Several Variables** 2.1 Graphs and level curves 2.2 Partial derivatives 2.3 Total derivative 2.4 Jacobian 2.5 Euler's Theorem for Homogeneous functions	**08**
3	**Extreme Values** 3.1 Extrema of functions of two or more variables 3.2 Necessary conditions for Extreme values 3.3 Second derivative test (without proof) **3.4** Lagrange Multipliers with one constraint	**07**
4	**Vector calculus** 4.1 Vector Fields 4.2 Curl and Divergence 4.3 Gradient vector 4.4 Gradient Descent Method	**08**

Learning Resources- References

Sr. No.	References
1.	Multivariable calculus (seventh edition) James Stewart MC master university and university of Toronto.
2.	Thomas Jr., G.B., Weir, M.D. and Hass, J. Thomas' Calculus (12th ed.). Pearson, Boston, New York, 2010.

	ELS-322 - Wireless Communication Minor-Theory	
	Number of Credits: 02 No. of Hours:30	
Course Outcomes (COs) On completion of the course, the students will be able to:		**Bloom's cognitive level**
CO1	Describe digital modulation techniques for different applications.	1
CO2	Discuss and summarize developments from 1G to 5G Cellular systems.	2
CO3	Demonstrate different wireless systems to know the features of various technologies.	3
CO4	Compare different generations of Cellular communication systems.	4
CO5	Evaluate GPS system and its features.	5

ELS-322 - Wireless Communication
(Minor - Theory)

Unit No.	Title of Unit and Contents	No. of hours
1	**Data Transmission and multiple access Techniques** 1.1 ASK,FSK,BPSK, QPSK,QAM 1.2 Introduction to multiple access: FDMA, TDMA, CDMA 1.3 Spread Spectrum techniques: Frequency Hopping Spread Spectrum (FHSS), Direct Sequence Spread Spectrum (DSSS)	**10**
2	**Introduction to wireless communication: Mobile Communication** 2.1 Need of wireless communication systems, Wired versus wireless communication 2.2 Antenna: Introduction, Need, working Principle, 2.3 Parameters of antenna: Gain, directivity, Radiation pattern, Beam width, Bandwidth, Front to Back Ratio (FBR), 2.4 Fundamentals of cellular system**:** Cell structure **(**Hexagonal cell geometry), Cluster, Co-channel interference, Frequency reuse concept. 2.5 Cellular systems from 1G to 5G, LTE, IEEE wireless protocol 802.11 2.6 GSM: Architecture, Call routing, Mobility management, Hand off	**14**
3	**GPS system** 3.1 Introduction 3.2 Components of GPS system (space segment, control segment, user segment) 3.3 GPS receiver 3.4 Applications	**06**

Learning Resources- References

Sr. No.	References
1.	Communication Electronics Principles and Applications – Louis E. Frenzel, Tata McGraw Hill Education Private Limited, 3rd Edition.
2.	Data Communications and Networking – Behrouz A Forouzan, Tata McGraw Hill Education Private Limited, Fourth Edition
3.	Wireless Communication and Networks – William Stallings, Pearson Education, Second Edition.
4.	Mobile Computing, Asoke K Talukder, Roopa R Yavagal, TMH
5.	Mobile Communications, Jochen Schiller, Pearson Education, 2nd Edition
6.	Wireless Communications and Networks, 3G and beyond, ITI SahaMisra, TMH. 2nd Edition.

7.	Principle of wireless Networks by Kaveh Pahlavan and Prashant Krishnamurthy, Pearson Education, 2002.

	STS-322 - Statistical Methods-III **Minor-Theory**	
	Number of Credits: 02 **No. of Hours:30**	
Course Outcomes (COs) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Identify the errors involved in using sample data for prediction	1
CO2	Infer the reliability of hypothesis scientifically using different tests of hypothesis.	2
CO3	Apply appropriate simulation techniques to match simulated outcomes closely with real outcomes.	3
CO4	Explain research questions using the sample data.	4
CO5	Test an assumption regarding population parameters using sample data.	5
CO6	Develop application of test procedures to different hypothesis problems.	6

STS-322-Statistical Methods-III
(Minor- Theory)

Unit No.	Title of Unit and Contents	No. of hours
1	**Bivariate continuous probability distribution** 1.1 Definition bi-variate random vector of variable (X,Y), its joint p.d.f. and its distribution function and their properties. 1.2 Concepts of marginal and conditional probability distributions. 1.3Independence of r.v. (X,Y) based on joint and marginal p.m.f. 1.4 Examples and problems.	**07**
2	**Testing of hypothesis** 2.1 Definitions: population, statistic, SRSWR, SRSWOR, random sample from a probability distribution, parameter, statistic, standard error of estimator. 2.2 Concept of null hypothesis and alternative hypothesis, critical region, level of significance, type I and type II error, one sided and two sided tests, p-value.	**04**
3	**Large Sample Tests** 3.1 H_0: $\mu = \mu_0$ Vs H_1: $\mu \neq \mu_0$, $\mu < \mu_0$, $\mu > \mu_0$ (One sided and two-sided tests), H_0: $\mu_1 = \mu_2$ Vs H_1: $\mu_1 \neq \mu_2$, $\mu_1 < \mu_2$, $\mu_1 > \mu_2$ (One sided and two-sided tests). 3.2 H_0: $P = P_0$ Vs H_1: $P \neq P_0$, $P < P_0$, $P > P_0$ (One sided and two-sided tests), H_0: $P_1 = P_2$ Vs H_1: $P_1 \neq P_2$, $P_1 < P_2$, $P_1 > P_2$ (One sided and two-sided tests). 3.3 Numerical problems related to real life situations	**08**
4	**Non parametric tests** 4.1 Run test 4.2 Sign test 4.3 Median test, 4.4Wilcoxon's Signed Rank test 4.5 Numerical problems related to real life situations.	**06**

5	**Queueing Model** 5.1 M/M/1: FIFO as an application of exponential distribution, Poisson distribution and Geometric distribution 5.2 Inter-arrival rate (λ) service rate (μ), traffic intensity ($\rho = \lambda/\mu<1$), queue discipline 5.3 probability distribution of number of customers in queue, average queue length 5.4 average waiting time in queue, system.	**05**

Learning Resources- References

Sr. No.	References
1.	Probability, Statistics, Design of Experiments and Queuing theory with applications Computer Science, Trivedi K.S., Prentice Hall of India, New Delhi, 2001.
2.	Statistical Methods, G.W. Snedecor, W.G. Cochran, John Wiley & sons, 1989.
3.	Fundamentals of Applied Statistics (4th Edition), Gupta and Kapoor, S. Chand and Sons, New Delhi, 2014.
4.	Modern Elementary Statistics, Freund J.E., Pearson Publication, 2005.
5.	A First course in Probability 6th Edition, Ross, Pearson Publication, 2006.
6.	Common Statistical Tests, Kulkarni M.B., Ghatpande S.B., Gore S.D., Satyajeet Prakashan, Pune, 1999.

CSC-345 Field Project **Field Project** **Theory/Practical**
Number of Credits: 02 **No. of Hours: 60**

T. Y. B. Sc. Computer Science Semester - VI		
	CSC-351 - Operating System-II **Major-Theory**	
	Number of Credits: 02 **No. of Hours:30**	
Course Outcomes (COs) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Describe different concepts of operating system.	1
CO2	Discuss the concept of file systems and free space management.	2
CO3	Apply deadlock handling techniques to determine existence of deadlock and recover it.	3
CO4	Explain the concepts of memory management.	4
CO5	Compare and analyze the performance of different algorithms.	5
CO6	Write and implement different operating system related algorithms.	6

CSC-351 - Operating System-II
(Major - Theory)

Unit No.	Title of Unit and Contents	No. of hours
1	**Process Scheduling** 1.1 Basic Concept - CPU-I/O burst cycle, CPU scheduler, Preemptive Scheduling, Dispatcher 1.2 Scheduling Criteria, Scheduling Algorithms - FCFS, SJF, Priority scheduling, Round-Robin scheduling, Multiple queue scheduling, Multilevel feedback queue scheduling	**06**
2	**Deadlocks** 2.1 System model Deadlock Characterization - Necessary conditions 2.2 Resource allocation graph 2.3 Deadlock Prevention 2.4 Deadlock Avoidance - Safe state, Resource allocation graph algorithm 2.5 Banker's Algorithm, Deadlock Detection 2.6 Recovery from Deadlock - Process termination, Resource Preemption	**06**
3	**Process Synchronization** 3.1 Background, Interprocess Communication 3.2 Critical Section Problem 3.3 Semaphores: Usage, Implementation	**03**
4	**Memory Management** 4.1 Background - Basic hardware, Address binding 4.2 Logical versus physical address space, Dynamic loading 4.3 Dynamic linking and shared libraries, Swapping 4.4 Contiguous Memory Allocation - Memory mapping and protection, Memory allocation, Fragmentation 4.5 Paging - Basic method, Hardware support, Protection, Shared Pages 4.6 Segmentation - Basic concept, Hardware 4.7 Virtual Memory Management – Background	**10**

	4.8 Demand paging, Performance of demand paging 4.9 Page replacement - FIFO, OPT, LRU, Second chance page replacement	
5	**File System** 5.1 File concept 5.2 Access Methods - Sequential, Direct, Other access methods 5.3 Directory and Disk Structure – Storage structure, Directory overview, Single level directory, Two level directory, Tree structure directory, Acyclic graph directory, General graph directory 5.4 Allocation Methods - Contiguous allocation, Linked allocation, Indexed allocation 5.5 Free Space Management - Bit vector, Linked list	**05**

Learning Resources- References

Sr. No.	References
1.	Pabitra Pal Choudhary, "Operating Systems: Principles and Design", PHI Learning Pvt. Ltd., 2011
2.	Siberchatz, Galvin, Gagne, "Operating System Concepts" Willey Publication (8^{th} Edition), 2008

	CSC-352 - Java Programming-II **Major-Theory**	
	Number of Credits: 02 **No. of Hours:30**	
Course Outcomes (COs) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Recall the object-oriented features to design platform independent applications.	1
CO2	Represent dynamic data structures using Collection Framework.	2
CO3	Able to develop multithreaded applications with synchronization	3
CO4	Connect java application using JDBC.	4
CO5	To learn Server-Side Programming using Servlets and Java Server Pages	5
CO6	Able to design web based applications and develop networking based application	6

CSC-352 - Java Programming-II
(Major - Theory)

Unit No.	Title of Unit and Contents	No. of hours
1	**Collection** 1.1 Introduction to the Collection framework 1.2 List : ArrayList, LinkedList,Vector, Stack, Queue 1.3 Set : HashSet ,TreeSet, LinkedHashSet 1.4 Map:HashMap, LinkedHashMap, Hashtable and TreeMap 1.5 Interfaces: Comparator, Iterator ,ListIterator	**03**
2	**Database Programming** 2.1 The design of JDBC 2.2 JDBC configuration 2.3 Types of drivers 2.4 Executing SQL statements, query execution 2.5 Scrollable and updatable ResultSet 2.6 Metadata: DatabaseMetaData, ResultSetMetaData 2.7 Transactions–commit(), rollback(), SavePoint (Database :PostgreSQL)	**06**
3	**Multithreading** 3.1 What are threads? 3.2 Life cycle of a thread 3.3 Thread class 3.4 Thread priorities 3.5 Running Multiple threads 3.6 The Runnable interface 3.7 Synchronization and inter thread communication	**05**

4	**Servlet** 4.1 Introduction to Servlet and hierarchy of Servlet 4.2 Life cycle of servlet 4.3 Tomcat – Introduction, configuration 4.4 Handling Get and Post request (HTTP) 4.5 Passing a data from HTML to servlet 4.6 Retrieving a data from database to servlet 4.7 Session tracking – Authorization, Cookies, URL rewriting, Hidden form fields, HttpSession	**06**
5	**JSP** 5.1 Introduction to JSP 5.2 Life cycle of JSP 5.3 Implicit Objects 5.4 Scripting elements –Declarations, Expressions, Scriptlets, Comments 5.5 Simple JSP program 5.6 JSP Directives -Page directive, include directive 5.7 Mixing scriptlets and HTML 5.8 Forward Request from Java Servlet to JSP with Data 5.9 User defined functions in JSP 5.10 Session handling	**06**
6	**Networking** 6.1 Networking basics – Protocol, Addressing, DNS, URL,Socket and Port 6.2 The java.net package –InetAddress, URL, URLConnection, SocketServer and Socket class 6.3 Creating a Socket to a remote host on a port (creating TCP client and server) 6.4 Simple socket program examples	**04**

Learning Resources- References

Sr. No.	References
1.	Steven Holzner Java 2 Programming Black Book dreamtech Press.
2.	Bryan Basham, Kathy Sierra, and Bert Bates ,Head First Servlets and JSP
3.	https://www.javatpoint.com
4.	https://www.javatpoint.com/

	CSC-353 - Computer Networks- II Major-0Theory	
	Number of Credits : 02 **No. of Hours : 30**	
Course Outcomes (COs) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Describe different protocols operating at transport and application layer.	1
CO2	Discuss network security concepts.	2
CO3	Solve problems based on cryptography.	3
CO4	Explain and determine different error detection and correction methods.	4
CO5	Compare TCP and UDP protocols.	5
CO6	Specify web architecture and HTTP.	6

CSC-353 - Computer Networks-II
(Major - Theory)

Unit No.	Title of Unit and Contents	No. of hours
1	**The Transport Layer** 1.1 Process-to-Process Delivery Client Server Paradigm 1.2 Multiplexing and De-multiplexing Connectionless Vs Connection-Oriented Service 1.6 Reliable Vs Unreliable, UDP,TCP	**03**
2	**User Datagram Protocol** 2.1 Datagram Format 2.2 Checksum 2.3 UDP operations, Use of UDP	**03**
3	**Transmission Control Protocol** 3.1 TCP Services – Process to Process Communication, Stream Delivery Service, sending and Receiving Buffers, Segments 3.2 Full –Duplex Communication, Connection oriented service, Reliable service, 3.3 TCP Features –Numbering System, Byte Number, Sequence Number, Acknowledgement Number, Flow Control, Error Control, Congestion Control 3.4 TCP Segment – Format, TCP connection, Error Control, Flow Control, Congestion Control – open loop and close loop	**09**
4	**The Application Layer** 4.1Domain Name System (DNS) Name space Domain, Name Space, Distribution of Name Space, DNS in the Internet, Resolution, E-MAIL Architecture, User Agent, Message Transfer Agent-SMTP, Message Access Agent-POP3, IMAP4 4.2 Web Based Mail, File Transfer Protocol (FTP) Communication over control connection, Communication over Data Connection, Anonymous FTP, WWW Architecture, WEB Documents, HTTP - HTTP Transaction, Persistent and Non persistent Connection, Proxy Server	**09**

5	**Network Security** 5.1 Introduction, The Need for Security, Security Approaches Principles of Security, Types of Attacks 5.2 Cryptography: Concepts and Techniques – Introduction, plain text and cipher, Substitution techniques – Caesar Cipher, Modified version of Caesar Cipher, Mono-alphabetic Cipher (Problems should be covered) 5.3 Communication Security Firewalls 5.4 Social Issues - Privacy, Anonymous Remailers, Freedom of Speech, Steganography 5.5 Copyright	**06**

Learning Resources- References

Sr. No.	References
1.	Behrouz A. Forouzan :Data Communication and Networking Fourth Edition, TATA McGrawHill

	CSC-354 - Compiler Construction **Elective-Theory**	
	Number of Credits: 02 **No. of Hours:30**	
Course Outcomes (COs) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Describe the different phases and passes of the compiler.	1
CO2	Understand the process of scanning and parsing.	2
CO3	Use the compiler tools like LEX, YACC to meet the requirement of the realistic constraints of compilers.	3
CO4	Explain and construct different types of parsers.	4
CO5	Test and evaluate code generation and optimization techniques.	5
CO6	Integrate the concepts of syntax-directed translation method and implement the compiler.	6

CSC-354 - Compiler Construction
(Elective - Theory)

Unit No.	Title of Unit and Contents	No. of hours
1	**Introduction to compilers** 1.1 Definition of Compiler, interpreter and its difference 1.2 Phases of Compiler – Lexical Analysis, Syntax Analysis 1.3 Semantic Analysis, Intermediate Code generation 1.4 Code optimization, code generation. 1.5 Error Handling. 1.6 Introduction to one pass & Multi pass compilers 1.7 Cross compiler, Bootstrapping	**04**
2	**Lexical Analysis (Scanner)** 2.1 Review of Finite automata as a lexical analyzer 2.2 Applications of Regular Expressions and Finite Automata (lexical analyzer, searching using RE) 2.3 Input buffering, Recognition of tokens. 2.4 LEX: A Lexical analyzer generator	**04**
	Syntax Analysis (Parser) 3.1 Definition, Types of Parsers Top-Down Parser – Top-Down Parsing with Backtracking: Method & Problems 3.1.1 Drawbacks of Top-Down parsing with backtracking 3.2 Elimination of Left Recursion (direct & indirect) 3.3 Need for Left Factoring & examples 3.4 Recursive Descent Parsing: Definition Implementation of Recursive Descent Parser Using Recursive Procedures 3.5 Construction of LL (1) Parsing Table 3.5.1Parsing of a String using LL (1) Table. 3.6 Bottom-Up Parsers 3.6.1 Operator Precedence Parser -Basic Concepts 3.6.2 Operator Precedence Relations form Associativity & Precedence 3.6.3 Operator Precedence Grammar, Algorithm for LEADING & TRAILING (with ex.) , Algorithm for Operator Precedence Parsing (with ex.)	**14**

	3.6.4 Precedence Functions 3.7 Shift Reduce Parser 3.7.1 Reduction, Handle, Handle Pruning 3.7.2 Stack Implementation of Shift Reduce Parser 3.8 LR Parser: Model, Types [SLR (1), Canonical LR, LALR]-Method & examples.	
4	**Syntax Directed Definition** 4.1 Syntax Directed Definitions (SDD) , Inherited & Synthesized Attributes 4.2 Evaluating an SDD at the nodes of a Parse Tree, Example , Evaluation Orders for SDD's 4.3 Dependency Graph , Ordering the Evaluation of Attributes 4.4 S-Attributed Definition, L-Attributed Definition 4.5 Application of SDT 4.6 Translation Schemes: Definition , Postfix Translation Schemes	**04**
5	**Code Generation and Optimization** 5.1 Compilation of expression – Concepts of operand descriptors and register descriptors 5.2 Intermediate code for expressions – postfix notations, Triples, Quadruples and Expression trees. 5.3 Code Optimization 5.3.1 Optimizing transformations 5.3.2 Compile time evaluation, 5.3.3 Elimination of common sub expressions 5.3.4 Dead code elimination, 5.3.5 Frequency reduction, strength reduction. 5.4 Three address code 5.5 DAG for Three address code 5.6 The Value-number method for constructing DAG's. 5.7 Definition of basic block, Basic blocks, and flow graphs 5.8 Directed acyclic graph (DAG) representation of basic block.	**04**

Learning Resources- References

Sr. No.	References
1.	Compilers: Principles, Techniques, and Tools, Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, 2004
2.	Principles of Compiler Design By: Alfred V. Aho, Jeffrey D. Ullman, Narosa Publication House, 2002
3.	LEX & YACC, 2nd edition, O'reilly Publication, 2012

	CSC-355 - Software Project Management-II **Elective-Theory**	
	Number of Credits: 02 **No. of Hours:30**	
Course Outcomes (COs) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Recognize challenges and complexities in the software development environment and understand the software metrics	1
CO2	Identify factors influencing project feasibility for informed decision-making in Human resource allocation	2
CO3	To learn to select and apply project management techniques for process modelling, planning, estimation, process metrics and risk management	3
CO4	Analyze risk management strategies for project quality and risk mitigation to achieve quality standard	4
CO5	Implement Risk Management strategies.	5
CO6	Apply the SPM concepts in various case studies to achieve quality standards	6

CSC-355 - Software Project Management-II
(Elective - Theory)

Unit No.	Title of Unit and Contents	No. of hours
1	**Cost Management** 1.1 Cost estimation 1.2 Cost Control 1.3 COCOMO model 1.4 BASIC COCOMO NUMERICALS 1.5 Case Study on COCOMO model	**12**
2	**Quality Management** 2.1 Quality planning and assurance 2.2 Human Resource Management - Organizational planning, Staff acquisition 2.3 Communication Management - Information distribution, Reporting 2.4 Risk Management - Risk identification, Quantification and control	**08**
3	**Software Metrics** 3.1 The scope of software metrics 3.2 Size- oriented metrics 3.3 Function oriented 3.4 Software metrics data collection 3.5 Analyzing software data	**06**
4	**Quality Standards** 4.1 CMM levels 4.2 Quality Standards	**04**

Learning Resources- References

Sr. No.	References
1.	Software Engineering Roger Pressman McGraw-Hill
2.	Software Metrics for Project Management and process improvement Robert B. Grady Prentice hill
3.	Pankaj Jalote, Software Project Management in Practice, Pearson Education Asia (2002).
4.	Bob Hughes and Mike Cotterell, Software Project Management, Tata McGraw Hill Publishing Company Ltd., New Delhi (2006) 3rd ed.
5.	Roger Pressman, A practitioner's Guide to Software Engineering, Tata McGraw Hill (2004).
6.	Tom Demarco, Controlling Software Project Management, Measurement, Prentice Hall, New Jersey (1982).
7.	Watts S. Humphrey, Winning with Software An Executive Strategy, Pearson Education Asia (1998).
8.	Philip Metzger, Managing A Programming Project, Prentice Hall, New Jersey (1983).
9.	Tom Glib, Finzi Susannah, Principles of Software Engineering Management, Addison Wesley, England
10.	Software Engineering Roger Pressman McGraw-Hill
11.	https://www.javatpoint.com/

	CSC-356 - Introduction to Data Analytics **Elective-Theory**	
	Number of Credits: 02 **No. of Hours:30**	
Course Outcomes (COs) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Define the key objectives of data analytics and describe its scope in different domains	1
CO2	Classify various machine learning techniques.	2
CO3	Explain relationship between variables. Synthesize the correlation between two quantitative variables using statistical terms.	3
CO4	Construct models using various algorithms.	4
CO5	Evaluate performance of algorithms using evaluation.	5
CO6	Integrate machine learning algorithms / techniques to construct use case-based models and achieve expected accuracy.	6

CSC-356 - Introduction to Data Analytics
(Elective - Theory)

Unit No.	Title of Unit and Contents	No. of hours
1	**Introduction to Data Analytics** 1.1 Inferential Statistics - Motivation 1.2 Inferential Statistics - Single sample tests 1.3 Two Sample tests 1.4 Type 1 and Type 2 Errors 1.5 Confidence Intervals 1.6 ANOVA and Test of Independence	**07**
2	**Introduction to Machine Learning** 2.1 Supervised Learning 2.2 Unsupervised Learning 2.3 Reinforcement Learning 2.4 Training Vs Testing 2.5 Performance Evaluation measures	**06**
3	**Supervised Learning** 3.1 Logistic Regression 3.2 Training a Logistic Regression Classifier 3.3 Classification and Regression Trees 3.4 Naïve Bayes 3.5 Ensemble Methods and Random Forests 3.6 Bias Variance Dichotomy 3.7 Model Assessment and Selection	**10**

4	**Unsupervised Learning** 4.1 Clustering 4.2 Types of clustering 4.3 K-means clustering 4.4 Associative Rule Mining: Overview, Mining association rule	**05**
5	**Case study**	**02**

Learning Resources- References

Sr. No.	References
1.	Yu-Wei, Chiu (David Chiu), "Machine Learning with R cookbook" First Edition PACKT publishing, 2015.
2.	Cory Lesmeister, "Mastering Machine Learning with R", First Edition PACKT publishing, 2015
3.	Ian W itten Eibe Frank Mark A. Hall, "Data Mining Practical Machine Learning Tools and Techniques", Third Edition Morgan Kaufmann Publishers First Edition, 2011
4.	Jiawei Han, Micheline Kamber, Jian Pei, "Data Mining: Concepts and Techniques", 3 rd Edition, 2011
5.	R. O. Duda, P. E. Hart, D. G. Stork, "Pattern Classification", 2 nd edition. John Wiley and Sons, 2000
6.	www.analyticsvidya.com
7.	www.udemy.com
8.	https://towardsdatascience.com/machine-learning/home
9.	http://epgp.inflibnet.ac.in/

	CSC-357 - Computer Graphics-II Elective-Theory	
	Number of Credits: 02 No. of Hours:30	
Course Outcomes (COs) On completion of the course, the students will be able to:		**Bloom's cognitive level**
CO1	Describe Three-Dimensional Graphics.	1
CO2	Illustrate techniques for 3-dimensional display	2
CO3	Apply Scaling, Rotation, Viewing, transformation.	3
CO4	Explain different algorithms for 3-dimensional transformation	4
CO5	Determine the need for hidden surface removal	5
CO6	Design 3-dimension rotation, clipping with algorithm.	6

CSC-357 - Computer Graphics-II
(Elective - Theory)

Unit No.	Title of Unit and Contents	No. of hours
1	**Three Dimensional Graphics** 1.1 Introduction 1.2 Need for 3-Dimensional Imaging 1.3 Techniques for 3-Dimesional displaying 1.4 Parallel Projections 1.5 Perspective projection 1.6 Intensity cues 1.7 Stereoscope effect 1.8 Kinetic depth effect 1.9 Shading	**10**
2	**Three Dimensional Transformations** 2.1 Introduction 2.2 Three-Dimensional transformation 2.3 Translations 2.4 Scaling 2.5 Rotation 2.6 Viewing Transformation 2.7 The Perspective 2.9 Algorithms 2.9 Three Dimensional Clipping 2.10 Perspective view of Cube	**10**
3	**Hidden Surface Removal** 3.1 Introduction 3.2 Need for hidden surface removal 3.3 The Depth - Buffer Algorithm 3.4 Properties that help in reducing efforts 3.5 Scan Line coherence algorithm 3.6 Span - Coherence algorithm 3.7 Area-Coherence Algorithms 3.8 Warnock's Algorithm 3.9 Priority Algorithms	**10**

Learning Resources- References

Sr. No.	References
1.	Hearn/Baker**, "**Computer Graphics with OpenGL, 4e**",** Pearson Education India, Fourth Edition**, 2013.**
2.	Atul Godse, "Computer Graphics", Technical Publications, 2021.
3.	https://www.geeksforgeeks.org/introduction-to-computer-graphics/
4.	https://www.javatpoint.com

	CSC-361 - Computer Science Practical-8 **Major-Practical**	
	Number of Credits: 02 **No. of Hours: 60**	
Course Outcomes (COs) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	List the errors and warnings for the given input	1
CO2	Transform the algorithms into program code and construct appropriate data structures	2
CO3	Solve the problems based on each algorithm.	3
CO4	Explain and demonstrate the execution process of the programs	4
CO5	Validate the input and execute the programs with test inputs.	5
CO6	Write modularized program code for implementing various operating system algorithms and integrate them	6

CSC-361 - Computer Science Practical-8
(Major – Practical)

Sr. No.	**Title of Experiment / Practical**
1.	CPU Scheduling – FCFS
2.	CPU Scheduling –SJF
3.	CPU Scheduling – Priority
4.	CPU Scheduling – Round-Robin
5.	Banker's Algorithm – I
6.	Banker's Algorithm – II
7.	Demand Paging – FIFO
8.	Demand Paging – LRU
9.	Demand Paging – LFU/MFU
10.	File Allocation – Continuous
11.	File Allocation –Linked
12.	File Allocation -Indexed
13.	Data Analytics case study-1
11.	Data Analytics case study-2
12.	Student Activity

	CSC-362 - Computer Science Practical-9 **Major-Practical**	
	Number of Credits: 02 **No. of Hours: 60**	
Course Outcomes (COs) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Define various dynamic data structures using Collection Framework in Java.	1
CO2	Articulate concept of database connectivity and executing database queries.	2
CO3	Demonstrate server side technology for development of web applications.	3
CO4	Develop dynamic web pages using JSP	4
CO5	Select architecture for network based application using socket programming.	5
CO6	Construct a game using multithreading.	6

CSC-362 - Computer Science Practical-9
(Major – Practical)

Sr. No.	**Title of Experiment / Practical**
1.	Collections -I Based on List, Set
2.	Collections -II Based on Map, Comparator Interface
3.	Database Programming-I
4.	Database Programming-2
5.	Multithreading
6.	Servlet
7.	Servlet with Database
8.	JSP
9.	JSP with Database
10.	Networking
11.	Designing a web-application-1
12.	Designing a web-application-2
13.	Student Activity-1
14.	Student Activity-2
15.	Student Activity-3

	CSC-382 - Computer Science Practical-10 (Project-2) **VSC -Practical**	
	Number of Credits: 02 **No. of Hours: 30**	
Course Outcomes (COs) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Define the activities involved in the project.	1
CO2	Illustrate the different state of the system.	2
CO3	Outline the test cases.	3
CO4	Structure the system using various UML diagrams.	4
CO5	Test and validate all inputs.	5
CO6	Develop project with code construction.	6

CSC-382 - Computer Science Practical-10 (Project-2)
(VSC – Practical)

Sr. No.	**Title of Experiment / Practical**
1.	Behavioural Modelling (Sequence Diagram, Activity Diagram)
2.	State Diagram
3.	Architectural Modelling(Component Diagram, Deployment Diagram)
4.	Coding and Implementation
5.	Test Case Design
6.	Activity (Project Demo)
7.	Review Activity of First Demo
8.	Coding and Implementation Interlinking
9.	Coding and Implementation of Events
10.	Coding and Implementation Validation
11.	Documentation
12.	Activity (Final Project Demo)

	MTS-373 - Operations Research **Minor -Theory**	
	Number of Credits: 02 **No. of Hours:30**	
Course Outcomes (COs) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Identify real-world problems that can be modeled and solved using OR Techniques.	1
CO2	Explain formulation and solutions of linear programming models by graphical method.	2
CO3	Compute optimal solutions of LPP by using Simplex method.	3
CO4	Explain transportation and assignment models.	4
CO5	Evaluate optimal solutions of LPP using the transportation and assignment Algorithms.	5
CO6	Apply Operations research techniques to make decisions in field such as transportation and resource allocation.	6

MTS-373 - Operations Research
(Minor - Theory)

Unit No.	Title of Unit and Contents	No. of hours
1	**Modeling with Linear Programming:** 1.1 Two-Variable LP Model 1.2 Graphical LP Solution 1.3 Linear Programming Applications	**03**
2	**Simplex Method** 2.1 Standard form, Canonical form, IBFS 2.2 Simplex Method 2.3 Big M Method 2.4 Introduction to Dual LPP	**09**
3	**Transportation Model** 3.1 Introduction 3.2 Finding IBFS by using various methods 3.3 Optimal solution by MODI method	**06**
4	**Assignment Model** 4.1 Introduction 4.2 Hungarian Algorithm	**04**
5	**Game Theory** 5.1 Two Person Zero Sum Game 5.2 Algebraic Method 5.3 Dominance Principle 5.4 Graphical Method 5.5 Representation of Game as an LPP.	**05**
6	**Sequencing Problems** 6.1 Introduction 6.2 Processing n jobs through 2 machines 6.3 Processing n jobs through 3 machines 6.4 Processing n jobs through m machines	**03**

Learning Resources- References

Sr. No.	References
1.	S.D. Sharma. Operations Research, Kedar Nath Ram Nath & Company, 1992.
2.	Taha H. (2017). Operations Research: An Introduction (10th ed.), London: Pearson.
3.	P Shankara Iyer. Operations Research, McGraw Hill Companies, 2009.

	ELS-372 – IoT Applications **Minor -Theory**	
	Number of Credits: 02 **No. of Hours:30**	
Course Outcomes (COs) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Identify hardware and software components of IoT applications.	1
CO2	Discuss the flow diagram for IoT applications.	2
CO3	Apply correct methodology as per IoT applications.	3
CO4	Analyze different parameters required to test IoT applications.	4
CO5	Evaluate the expected output of designed IoT system.	5

ELS-372 – IoT Applications
(Minor - Theory)

Unit No.	Title of Unit and Contents	No. of hours
1	**Home Automation** 1.1 Smart Lightening 1.2 Smart Appliances 1.3 Intrusion Detection 1.4 Smoke/ Gas Detectors	**10**
2	**Smart Cities** 2.1 Smart Parking 2.2 Smart Lightening 2.3 Smart Roads	**10**
3	**Smart Environment Monitoring** 3.1 Weather Monitoring 3.2 Air Pollution Monitoring 3.3 Green House Control	**10**

Learning Resources- References

Sr. No.	References
1.	Bahga, Arshdeep, and Vijay Madisetti. Internet of Things: A hands-on approach, 1st edition, University press, 2014
2.	Simone Cirani, Gianluigi Ferrari, Marco Picone, Luca Veltri. Internet of Things: Architectures, Protocols and Standards, 1 st edition, Wiley Publications, 2019.
3.	Vermesan, Ovidiu, and Peter Friess, eds. Internet of things-from research and innovation to market deployment, 1st edition, Aalborg: River publishers, 2014.
4.	Tsiatsis, Vlasios, Tsiatsis, Vlasios, Stamatis Karnouskos, Jan Holler, David Boyle, and Catherine Mulligan, Internet of Things: technologies and applications for a new age of intelligence, 2nd edition, Academic Press, 2018.
5.	Study/Review any three research papers based on IoT applications.

	STS-372-Statistical Methods IV **Minor-Theory**	
	Number of Credits: 02 **No. of Hours:30**	
Course Outcomes (COs) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Recall Statistical population, sample and sampling distributions.	1
CO2	Infer the reliability of hypothesis scientifically using different tests of hypothesis.	2
CO3	Explain appropriate simulation techniques to match simulated outcomes closely with real outcomes.	3
CO4	Explain real life situations using sampling distributions.	4
CO5	Test an assumption regarding population variance using sample data.	5
CO6	Apply test of hypothesis for attributes.	6

STS-372- Statistical Methods- IV
(Minor- Theory)

Unit No.	Title of Unit and Contents	No. of hours
1	**Chi-square distribution** 1.1 Definition χ^2 random variable, p.d.f. of χ^2 random variable with n degrees of freedom. 1.2 Mean, variance and nature of p.d.f curve. 1.3 Computation of probabilities. 1.4 Normal approximation. Distribution of X/(X+Y) and X/Y, where X and Y are two independent χ^2 random variables.	**04**
2	**Student's t -distribution** 2.1 Definition t random variable n degrees of freedom, p.d.f. of t r.v. 2.2 Mean, variance and nature of p.d.f curve. 2.3Computation of probabilities. 2.4 Statement of Normal approximation.	**03**
3	**Snedecore's F- distribution** 3.1 F-distribution with n_1 and n_2 degrees of freedom, p.d.f. of F r.v. 3.2 Mean, variance and nature of p.d.f curve. 3.3 Computation of probabilities. 3.4 Interrelations among χ^2 , t and F variables	**03**
4	**Tests based on t, Chi-square and F-distribution** 4.1 H_0: $\mu = \mu_0$ Vs H_1: $\mu \neq \mu_0$, $\mu < \mu_0$, $\mu > \mu_0$ (One sided and two-sided tests), H_0: $\mu_1 = \mu_2$ Vs H_1: $\mu_1 \neq \mu_2$, $\mu_1 < \mu_2$, $\mu_1 > \mu_2$ (One sided and two-sided tests) 4.2 Paired t-test, Chi square test for goodness of fit, Test for independence of attributes (m X n contingency table) 4.3 Test for significance of variation for a population. (One sided and two sided tests) 4.4 Test for equality of population variances (One sided and two sided tests) 4.5 Numerical problems related to real life situations	**14**
5	**Simulation** 5.1 Introduction to Simulation, merits and demerits. 5.2 Pseudo-random number generator, requisites of a good random number	**06**

	generator, testing these requirements by using various test of hypothesis using Run test, Goodness of fit test, Sign test 5.3Model Sampling from uniform and exponential distribution, 5.4 Model sampling from Normal distribution using Box-Muller transformation 5.5 Numerical problems related to real life situations.	

Learning Resources- References

Sr. No.	References
1.	Probability, Statistics, Design of Experiments and Queuing theory with applications Computer Science, Trivedi K.S., Prentice Hall of India, New Delhi, 2001.
2.	Common Statistical Tests, Kulkarni M.B., Ghatpande S.B., Gore S.D., Satyajeet Prakashan, Pune, 1999.
3.	Fundamentals of Applied Statistics (4th Edition), Gupta and Kapoor, S. Chand and Sons, New Delhi, 2014.
4.	Modern Elementary Statistics, Freund J.E., Pearson Publication, 2005.
5.	A First course in Probability 6th Edition, Ross, Pearson Publication, 2006.

CSC-395 OJT **(On Job Training-Theory/Practical)** **Theory/Practical**
Number of Credits: 4 **No. of Hours: 120**