INSTITUTE OF ENGINEERING AND TECHNOLOGY

DOCTOR HARISINGH GOUR VISHWAVIDYALAYA, SAGAR (M.P.)
470003
(A CENTRAL UNIVERSITY)
NAAC A+ Accreditation
(Approved by AICTE, New Delhi)

Curriculum Framework & Syllabus of

UNDERGRADUATE PROGRAMME
B.Tech. in

COMPUTER SCIENCE AND ENGINEERING

IInd Year

(IIIrd and IVth Semester)

Courses effective from Academic Session 2024-2025

Based on
National Educational Policy (NEP) -2020

Date of BoS:
27/09/2024

PREAMBLE

The curriculum of B.Tech. Computer Science and Engineering program is prepared in accordance with the curriculum framework of AICTE. Further this Outcome Based Curriculum (OBC) is designed with Choice Based Credit and Semester System (CBCSS) In addition; the curriculum and syllabi are designed in a structured approach by deploying Feedback Mechanism on Curriculum from various stakeholders viz. Industry, Potential Employers, Alumni, Academia, Professional Bodies, Research Organizations and Parents to capture their voice of the respective stakeholders. The Curriculum design, delivery, and assessment, the three major pillars of academic system is completely aligned in line with Outcome Based Education (OBE) to assess and evaluate the learning outcomes to facilitate the learners to achieve their Professional and Career Accomplishments. The Vision To become the Centre of Excellence for technically competent and innovative computer engineers.

The B.Tech. in Computer Science and Engineering at Institute of Engineering and Technology focuses on teaching the fundamentals of hardware and software, algorithm analysis, and mathematics and science knowledge. The programme provides students with solid programming and engineering fundamentals as well as research and innovation skills in computer engineering. Artificial Intelligence, Machine Learning, Data Analytics, Cloud Computing, High-Performance Computing, Internet of Things, Network and Cyber Security, and Computer Forensics are among the cutting-edge technologies taught by experienced and eminent faculty.

For Semester III

S.No.	Nature of Courses	Credits
1.	Core Courses	12
2.	Basic Science Courses	8
3.	Laboratory Courses/Practical	2
	Total	**22 Credits**

For Semester IV

S.No.	Nature of Courses	Credits
1.	Core Courses	18
2.	Laboratory Courses/Practical	4
	Total	**22 Credits**

[A] Scheme of Examination:

(a) Theory Block

1.	Mid exam (internal)	i Mid-I	: 20%
		ii Mid-II (IA)	: 20%
		(Assignments, tutorials, regularity, quizzes, class test)	
2.	End Exam (external)	i End-semester examination	: 60%
Total			: 100%

(b) Practical Block

1.	Mid exam (internal)	i Mid-I	: 20%
		ii Mid-II (IA)	: 20%
		(Lab work, field work/seminar, quizzes, assignments and regularity)	
2.	End Exam (external)	i End-semester examination	: 60%
Total			: 100%

(c) Project Evaluation:

1.	Mid exam (internal)	i Mid-I Presentation and evaluation of Synopsis	: 20%
		ii Mid-II (IA) Presentation and evaluation of Progress of work	: 20%
2.	End Exam (external)	i End-semester examination ▪ Evaluation of Project ▪ Presentation ▪ Viva	: 60%
	Total		: 100%

[B] Assessments:

Internal Assessment (IA):

Each theory course, practical and project must clearly mention the methodology of assessment i.e. assignment, presentation, group discussion etc depending on the number of students in the class and feasibility of adopting a particular methodology. The distribution of marks for internal assessments (IA) shall be as follows;

(i)	Evaluation of the assignment, presentation, group discussion etc	:	10 Marks
(ii)	Attendance	:	10 Marks

The marks for attendance shall be awarded as follows:

(i)	75 % and Below	:	00 Mark
(ii)	>75 % and upto 85 %	:	04 Mark
(iii)	>85 % and upto 95 %	:	08 Marks
(iv)	>95 % and above	:	10 Marks

Choice Based Grading System

Each course (Theory or Practical) is to be assigned 100 marks irrespective of the number of credits, and the mapping of marks to grades may be done as per the following table:

Range of Marks	**Assigned Grade**
91-100	A+
81-90	A
71-80	B+
61-70	B

51-60	C+
46-50	C
40-45	D
<40	F

The Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA) shall be calculated as under.

$$\text{SGPA} \quad \frac{\sum_{i=1}^{n} c_i p_i}{\sum_{i=1}^{n} c_i}$$

Where C, is the number of Credits assigned for the i subject of a Semester, pjs the grade point earned in that 1th subject, where i = 1, 2 …. n. is the number of subjects in that semester for which SGPA is to be calculated.

here NCj is the number of total Credits assigned for the Jth semester. SGj is the

$$\text{CGPA} \quad \frac{\sum_{i=1}^{n} SG_i NC_i}{\sum_{j=1}^{n} NC_i}$$

SGPA earnedin the Jth semester, where j = 1.2 ,m, is the number of semesters till which CGPA is being
calculated.

Credits earned through MOOCS shall not be included in SGPA/CGPA calculations.

AWARD OF DIVISION

Division shall be awarded only after successful completion of the course, on the basis of integrated performance of the candidate in all the four years as per following details:

CGPA Score	Divisions
CGPA<75	First Division with Distinction
7.5>CGPA<6.5	First Division
6.5> CGPA <5.0	Second Division

The conversion from grade to an equivalent percentage shall be according to thfollowing formula:

Percentage marks scored = CGPA obtained X 10

- ***The introductory note must also mention that to be eligible to appear in End Semester Examination a student must appear in Mid Semester Examination and internal Assessment.***
- ***Attendance: 75 % attendance in a course is mandatory for a student to appear in end semester examination. Minimum passing marks for internal and external exams 40% individually.***

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New Scheme Based on AICTE Flexible Curriculum

B.Tech Programme in Department of Computer Science and Engineering

Course structure

Semester – III

S.N.	Category	Subject Code	Subject Name	Hours			
				L	T	P	C
1	BSC	BTC BSC 301	Engineering Mathematics-III	3	1	0	4
2	BSC	BTC BSC 302	Energy and Environmental Engineering	3	1	0	4
3	PCC	BTC PCC 303	Data Structure	3	1	0	4
4	PCC	BTC PCC 304	Digital Electronics	3	1	0	4
5	PCC	BTC PCC 305	Data Communication	3	1	0	4
6	LC	BTC LC 306	Laboratory-I (DS and DE Lab)	0	0	4	2
7	INT	BTC INT 507	Internship-III	90 hrs Internship based on using various software- To be completed anytime during third/ forth semester. Its evaluation/credit 3 to be added in fifth semester.			
	Total			15	5	4	22
8	MC	BT 307	Indian Constitution	Non-Credit Course			
9	MC	NC 308	NCC/NSS	Non-Credit Course			

- MST-Engineering Mathematics
- CSE- Computer Science and Engineering
- INT- Internship

BSC- Basic Science Courses
PCC- Professional Core Courses
P- Practical
LC- Laboratory Courses
MC-Mandatory Courses

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Course structure

Semester – IV

S.N.	Category	Subject Code	Subject Name	Hours			
				L	T	P	C
1	PCC	BTC PCC 401	Discrete Structure	3	1	0	4
2	PCC	BTC PCC 402	Analysis and Design of Algorithm	3	1	0	4
3	PCC	BTC PCC 403	Operating System	3	1	0	4
4	PCC	BTC PCC 404	Software Engineering	2	1	0	3
5	PCC	BTC PCC 405	Computer Organization and Architecture	2	1	0	3
6	LC	BT C LC 406	Laboratory-II(ADA and SE Lab)	0	0	4	2
7	LC	BTC LC 407	Laboratory-III (Core Java and OS Lab)	0	0	4	2
8	INT	BTC INT 507	Internship-III	90 hrs Internship based on using various software- To be completed anytime during third/ forth semester. Its 3 evaluation/credit to be added in fifth semester.			
	Total			13	5	8	22
9	MC	BT 401	Cyber Security	Non-Credit Course			
10	MC	BT 401	Indian Constitution	Non-Credit Course			
11	MC	NC 401	NCC/NSS	Non-Credit Course			

- ESC-Engineering Science Course
- MST-Engineering Mathematics
- CSE- Computer Science and Engineering
- INT- Internship

BSC- Basic Science Courses
PCC- Professional Core Courses
P- Practical
LC- Laboratory Courses
MC-Mandatory Courses

Third Semester

(3rd Semester)

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B.Tech. Second Year (III semester)
Category- Basic Science Courses BSC

Course Category	Course Code	Course Title	L	T	P	C	Sessional		ESE	Total
							Mid I	Mid II (IA)		
BSC	BTC BSC 301	Engineering Mathematics-III	3	1	0	4	20	20	60	100

Course Objectives:

The objective of this course is to fulfill the needs of engineers to understand applications of Numerical Analysis, Transform Calculus and Statistical techniques in order to acquire mathematical knowledge and to solving wide range of practical problems appearing in different sections of science and engineering. More precisely, the objectives are:

- To introduce effective mathematical tools for the Numerical Solutions algebraic and transcendental equations.
- To enable young technocrats to acquire mathematical knowledge to understand Laplace transformation, Inverse Laplace transformation and Fourier Transform which are used in various branches of engineering.
- To acquaint the student with mathematical tools available in Statistics needed in various field of science and engineering.

Unit 1:

Numerical Methods: Solution of polynomial and transcendental equations: Bisection method, Newton-Raphson method and Regula-Falsi method. Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae.

Unit 2:

Numerical Methods: Numerical Differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules. Solution of Simultaneous Linear Algebraic Equations by Gauss Elimination method, Gauss-Jordan method, Crout's triangularisation method, Jacobi's method, Gauss-Seidal method.

Unit 3:

Numerical Methods: Ordinary differential equations: Taylor's series method, Picard's method, Euler's method, Euler's modified method. Runge Kutta method of fourth order, Milne's predictor-corrector method for solving first order differential equations. Partial differential equations: Finite difference solution of two-dimensional Laplace equations and Poission equations.

Unit 4:

Transform Calculus: Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Evaluation of integrals by Laplace transform. Finding inverse Laplace transform by different methods, convolution theorem (without proof). Application of Laplace transform in

solution to ordinary differential equations. Fourier transforms.

Unit 5:

Concept of Probability: Probability Mass function, Probability Density Function, Discrete Distribution: Binomial Distribution, Poisson's Distribution, Continuous Distribution: Normal Distribution, Exponential Distribution.

Course Outcomes: Upon successful completion of the course,	
CO1:	Learn about the various numerical methods of polynomial and transcendental equations
CO2:	This unit covers the numerical differentiation and integration. Solution of Simultaneous Linear Algebraic Equations
CO3:	This unit covers the numerical methods for Ordinary differential equations and partial differential equations
CO4:	This unit covers Transform Calculus.
CO5:	Learn about the concept of probability.

Essential Readings (Text Books)

- P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.
- S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.
- Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
- B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2010.
- N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi
- Publications, Reprint, 2010.

Suggested Readings (Reference Books)

- Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008.
- P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book
  - Stall, 2003 (Reprint).
- S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
- W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed.,
  - Wiley, 1968. Statistics

E-material

https://freevideolectures.com/course/2269/mathematics-iii

Evaluation: Evaluation will be continuous and integral part of the class followed by final examination.

Essential- Students can use **scientific calculator** (without memory) in internal as well as end semester exam in this paper.

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B.Tech. Second Year (III semester)
Category- Basic Science Courses **BSC**

Course Category	Course Code	Course Title	L	T	P	C	Sessional		ESE	Total
							Mid I	Mid II (IA)		
BSC	BTC BSC 302	Energy & Environmental Engineering	3	1	0	4	20	20	60	100

Course Objectives:
The objective of this Course is to provide an introduction to energy systems and renewable energy resources, with a scientific examination of the energy field and an emphasis on alternative energy sources and their technology and application.

Unit- 1

Introduction to Energy Science:

Introduction to energy systems and resources; Introduction to Energy, sustainability & the environment; Overview of energy systems, sources, transformations, efficiency, and storage; Fossil fuels (coal, oil, oil-bearing shale and sands, coal gasification) - past, present & future, Remedies & alternatives for fossil fuels - biomass, wind, solar, nuclear, wave, tidal and hydrogen; Sustainability and environmental trade-offs of different energy systems; possibilities for energy storage or regeneration

Unit- 2

Ecosystems

Concept of an ecosystem; Structure and function of an ecosystem; Producers, consumers and decomposers; Energy flow in the ecosystem; Ecological succession; Food chains, food webs and ecological pyramids; Introduction, types, characteristic features, structure and function of the following ecosystem (a.) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit- 3
Biodiversity and its conservation

Introduction – Definition: genetic, species and ecosystem diversity; Bio-geographical classification of India; Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values; Biodiversity at global, National and local levels; India as a mega-diversity nation; Hot-sports of biodiversity; Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; Endangered and endemic species of India; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Unit-4

Environmental Pollution

Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear; Solid waste Management: Causes, effects and control measures of urban and industrial wastes; Role of an individual in prevention of pollution; Pollution case stud management: floods, earthquake, cyclone and landslides.

Unit- 5

Social Issues and the Environment

From Unsustainable to Sustainable development; Urban problems related to energy; Water conservation, rain water harvesting, watershed management; Resettlement and rehabilitation of people; its problems and concerns. Case Studies Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies Wasteland reclamation; Consumerism and waste products; Environment Protection Act; Air (Prevention and Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Issues involved in enforcement of environmental legislation; Public awareness.

Essential Readings (Text Books)

- Boyle, Godfrey, Bob Everett, and Janet Ramage (Eds.) (2004), Energy Systemsand Sustainability: Power for a Sustainable Future. Oxford University Press.
- chaeffer, John (2007), Real Goods Solar Living Sourcebook: The CompleteGuide to Renewable Energy Technologies and Sustainable Living, Gaiam

Suggested Readings (Reference Books)

- Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc.
- Clark R.S., Marine Pollution, Clanderson Press Oxford (TB).
- Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001,Environmental Encyclopedia, Jaico Publ. House, Mumlbai,
- De A.K., Environmental Chemistry, Wiley Eastern Ltd.
- Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliancesand Standards', Vol I and II, Enviro Media (R)

Evaluation: Evaluation will be continuous and integral part of the class followed by final examination.

Essential- Students can use **scientific calculator** (without memory) in internal as well as end sem exam in this paper.

Course Outcomes:

Upon successful completion of the course,

CO1:	Learn about energy system, Fossils fuel, wind, soil, nuclear and many more
CO2:	Concept of ecosystem, energy flow, food chain and food web.
CO3:	Knowledge of biodiversity and its value.
CO4:	Detailed description of various types of pollution and its effects.
CO5:	Social issues like water conservation. Water harvesting etc related to environment.

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B.Tech. Second Year (III semester)
Category- Professional Core Course PCC

Course Category	Course Code	Course Title	L	T	P	C	Sessional		ESE	Total
							Mid I	Mid II (IA)		
PCC	BTC PCC 303	Data Structure	3	1	0	4	20	20	60	100

Course Objectives:
The objective of this course is to fulfill the needs of engineers to understand applications of Data Structures • To be familiar with the use of data structures as the foundational base for computer solutions to problems. • To understand various techniques of searching and sorting. • To understand basic concepts about stacks, queues, lists, trees and graphs.

Unit 1:
Introduction to Data Structures: Algorithms & their characteristics, asymptotic notations. arrays and its representations, index to address translation.

Unit 2:
Stacks: Concepts and implementation of stacks, operations on stack, conversion of infix to postfix notation, evaluation of postfix expression, recursion. Queues: Concepts and implementation, operations on queues, dequeue, priority queues, circular queues and application.

Unit 3:
Link list: Introduction, implementation of linked list, operations, circular link list, doubly linked list, polynomial manipulation using linked list
Trees: Types, terminology, binary tree -representations, traversal, conversion of general tree to binary tree, binary search tree, threaded binary tree and height balanced tree.

Unit 4:
Searching & Sorting: Linear search, binary search, bubble sort, selection sort, insertion sort, quick sort, merge sort, radix sort and heap sort, comparison between sorting techniques, hashing and collision resolution techniques.

Unit 5:
Graphs: Background, graph theory terminologies, representation of graphs- sequential & linked representation, path matrix, graph traversals- BFS, DFS, spanning trees, applications of graph.

Course Outcomes: Upon successful completion of the course,	
CO1:	Learn about the Algorithms and their complexities.
CO2:	Implementation of Linear Data Structures.
CO3:	Implementation of Linked List and Tree.
CO4:	Students will be able to implement tree, graph search and traversal algorithms
CO5:	Learn about the Graph.

Essential Readings (Text Books)

- Data Structures, Algorithms and Applications in C++, Sartaj Sahni, 2nd Edition.
- An Introduction to Data Structures with Applications, Jean-Paul Tremblay, Mcgraw hill.
- Data Structures & Algorithms, Aho, Hopcroft & Ullman, original edition, Pearson Publication.

Suggested Readings (Reference Books)

- An Introduction to Data Structures with Applications, Jean-Paul Tremblay, Mcgraw hill.
- Data Structures & Algorithms, Aho, Hopcroft & Ullman, original edition, Pearson Publication.

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Category- Professional Core Course PCC

Course Category	Course Code	Course Title	L	T	P	C	Sessional		ESE	Total
							Mid I	Mid II (IA)		
PCC	BTC PCC 304	Digital Electronics	3	1	0	4	20	20	60	100

Course Objectives:
Introduces the concept of Boolean algebra and the basic digital electronics. In this course, students will be able to understand Data processing circuits, Arithmetic Circuits, sequential circuits like registers, counters etc. based on flip flops. In addition, students will get an overview of microprocessor architecture and programming.

Unit I:
Review of number systems and number base conversions. Binary codes, Boolean algebra, Boolean functions, Logic gates. Simplification of Boolean functions, Karnaugh map methods, SOP-POS simplification, NAND-NOR implementation.

Unit II:
Combinational Logic: Half adder, Half subtractor, Full adder, Full subtractor, look- ahead carry generator,BCD adder, Series and parallel addition, Multiplexer – Demultiplexer, encoder- decoder, arithmetic circuits, ALU

Unit III:
Sequential logic: flip flops, D, T, S-R, J-K Master- Slave, racing condition, Edge & Level triggered circuits, Shift registers, Asynchronous and synchronous counters, their types and state diagrams. Semiconductor memories, Introduction to digital ICs 2716, 2732 etc. & their address decoding. Modern trends in semiconductor memories such as DRAM, FLASH RAM etc. Designing with ROM and PLA.

Unit IV:
Introduction to A/D & D/A convertors & their types, sample and hold circuits, Voltage to Frequency & Frequency to Voltage conversion. Multivibrators :Bistable, Monostable, Astable, Schmitt trigger, IC 555 & Its applications. TTL, PMOS, CMOS and NMOS logic. Interfacing between TTL to MOS.

Unit V:
Introduction to Digital Communication: Nyquist sampling theorem, time division multiplexing, PCM, quantization error, introduction to BPSK & BFSK modulation schemes. Shannon's theorem for channel capacity.

Course Outcomes Upon successful completion of the course,	
CO1:	Concepts of logical Gates
CO2:	Learning the Combinational Logic
CO3:	Learning the Sequential logic:
CO4:	Description about A/D & D/A convertors
CO5:	Introduction to Digital Communication:

Essential Readings (Text Books)

- Morris Mano, Digital Circuits & Logic Design, PHI
- Gothman, Digital Electronics, PHI
- Tocci, Digital Electronics, PHI
- Mavino& Leach, Digital Principles & Applications, PHI

Suggested Readings (Reference Books)

- Taub and schilling, Digital Integrated electronics.
- Simon Haykin, Introductionto Analog& Digital Communication, Wiley.
- Lathi B.P., Modern analog& digital communication, Oxford University.

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Category- Professional Core Courses P**CC**

Course Category	Course Code	Course Title	L	T	P	C	Sessional		ESE	Total
							Mid I	Mid II (IA)		
PCC	BTC PCC 305	Data Communication	3	1	0	4	20	20	60	100

Course Objectives:
The educational objectives of this course are • To Focus on information sharing and networks. • To Introduce flow of data, categories of network, different topologies. • To Focus on different coding schemes. • Brief the students regarding protocols and standards. • To give clear idea of signals, transmission media, errors in data communications and their correction, networks classes and devices.

Unit- 1

Introduction – Data Communication, Networks, Internet, Intranet, Protocols, Addressing**.** Introduction to digital communications, Components, Data Representation, Data Flow. Analog and Digital Signals and their representation, Transmission Impairment, Data Rate Limits-Nyquist's theorem, Shannon's theorem, Signal propagation, Signal types, Transmission mode and techniques, Transmission Media-Guided and Non-Guided, Noise.

Unit- 2

Encoding of Signals -Analog to Digital Conversion, Digital to Digital conversion, - Unipolar, Polar, Bipolar line & block codes, Digital to Analog, Analog to Analog conversion, Spread Spectrum-FHSS, DHSS, CDMA. Modulation and Demodulation of Signals. Multiplexing: FDM, TDM, and WDM, QAM. Data compression-Frequency dependent codes, Run length encoding, Relative encoding, LZ Compression.

Unit- 3

Switched Communication Networks: Circuit, Message, Packet & Hybrid Switching, Data Gram Network, Connection oriented services Vs Connectionless services. Public Switching Telephone Network, Digital Subscriber Line, ADSL, HDSL, SDSL, VDSL. Study of various types of topologies and their comparative study.

Unit-4
Reference model- OSI and TCP/IP model and its comparison, Layers in the model and its

requirement, critiques of OSI and TCP/IP model, Use of Computer Networks. Architecture of Internet. Addressing Physical, Logical, Port. Various Networking devices, Peer to Peer Protocols and service model.

Unit- 5

Data Link Layer: -Transmission Errors: Content Error, Error detection & Error correction ,Bit error rate , Error detection methods: Parity checking , Checksum Error Detection ,CRC ,Hamming code . Framing, Flow error Control - ARQ, Sliding Window Protocol, HDLC and PPP. L-2 Switches, Bridges.

Course Outcomes: Upon successful completion of the course:	
CO1:	Knowledge about different networks, models and signals.
CO2:	Learn how to do Analog to Digital Conversion,
CO3:	Learn how to implement Connection oriented services Vs Connectionless services.
CO4:	Deep study of both reference models.
CO5:	Study about Data link layer

Essential Readings (Text Books)

- C.L. Andrew Tannenbaum, Computer Networks, Pearson Education.
- William Stallings, Data and Computer Communication, Pearson Education.
- Behrouz A.Fourouzan, Data Communication and Networking, Mc Graw Hill Publication.
- Alberto Leon-Garcia, Indra Widjaja, Communication Networks-Fundamental concepts and key Architecture, TMH

Suggested Readings (Reference Books)

- Aftab Ahmad, Data Communication Principles for fixed and wireless networks, Kluwer Academic Publishers.
- Gilbert Held, Data Communications Networking Devices: -Operation, Utilization, Lan and Wan Interworking, John Wiley and Sons.

E-material

https://onlinecourses.nptel.ac.in/noc20_cs82/preview

Evaluation: Evaluation will be continuous and integral part of the class followed by final examination.

Essential- Students can use **scientific calculator** (without memory) in internal as well as end sem exam in this paper.

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B.Tech. Second Year (III semester)
Category- Laboratory courses **LC**

Course Category	Course Code	Course Title	L	T	P	C	Sessional		ESE	Total
							Mid I	Mid II (IA)		
LC	BTC LC 306	Laboratory-I (DS and DE Lab)	0	0	4	2	20	20	60	100

Prior knowledge
• Data Structure and Algorithms • Computer Programming and Problem Solving • Logic gates
Course Objectives:
• To apply various design strategies of algorithms. • To develop time and space efficient algorithms. • Introduction to Gate, Sequential and Combinational logic
Laboratory-I is a combination of Data Structure and Digital Electronics.

List of Experiments:

Data Structure Lab: - (1 credit) (Any 6)

1 Implementation of Array and linked list.
2 Implementation of Sorting Algorithms-Non-Recursive and Recursive.
3 Implementation of Searching Algorithms-Linear and Binary Search.
4 Implementation of Stack using Array.
5 Implementation of Queue using Array.
6 Implementation of Circular Queue using Array.
7 Implementation of Stack using Linked List.
8 Implementation of Queue using Linked List.
9 Implementation of Circular Queue using Linked List.
10 Implementation of Tree Structures, Binary Tree, Binary Search Tree, Insertion and Deletion in BST.
11 Graph Implementation, BFS, DFS

Digital Electronics Lab : - (1 credit) (Any 6)

1 To study and verify the truth tables of various Logic gates
2 To verify the properties of NAND and NOR gates as Universal Building Blocks.
3 Simplification and implementation of a Boolean function.
4 To study and verify the De Morgan's Theorem.
5 Implementation of basic Boolean arithmetic logic circuits such as Half-adder and Full adder.
6 Implementation of basic Boolean arithmetic logic circuits such as Half-subtractor and Full subtractor.
7 Conversion from Binary to Gray and Gray to Binary code.
8 Verify the truth table of RS, JK, T and D flip-flops.
9 Implementation of 4 X 1 multiplexer using logic gates.
10 Implementation of 1 X 4 De Multiplexer using logic gates.
11 To study natural sampling of continuous time waveforms using different sampling rates.
12 To study Pulse-Code modulation with Time-division multiplexing (PCM-TDM).
13 To study generation and detection of BPSK and QPSK waveforms.

Fourth Semester

(4th Semester)

INSTITUTE OF ENGINEERING AND TECHNOLOGY
DOCTOR HARISINGH GOUR VISHWAVIDYALAYA, SAGAR (M.P.) 470003
(A CENTRAL UNIVERSITY)
New Scheme Based on AICTE Flexible Curriculum

B.Tech. Second Year (IV semester)
Category- Professional Core Courses **PCC**

Course Category	Course Code	Course Title	L	T	P	C	Sessional		ESE	Total
							Mid I	Mid II (IA)		
PCC	BTC PCC 401	Discrete Structure	3	1	0	4	20	20	60	100

Course Objectives:
To enable the students to think logically and mathematically. To apply mathematical reasoning in which mathematical problems could be solved. To see the practical aspects of mathematical reasoning and combinatorial analysis. To be able to design algorithms for solving various problems using the concepts of discrete structures.

Unit- 1
Set Theory: Definition of sets, Set Representation: Set Builder Form, Roster Form, Cartesian product, Types of Sets, Power set, Set operations, Countable and Uncountable sets, Venn Diagrams, proofs of some general identities on sets. Cardinality of a set, Principle of inclusion and exclusion, Mathematical Induction.

Unit- 2
Relations and Functions:
Relation: Definition, types of relations, composition of relations, domain and range of relation, Pictorial representation of relation, Equivalence relation, Partial ordering relation,
Function: Definition, types of functions, Composition of functions, Inverse of a Function, Pigeonhole principle

Unit- 3
Logics and Proofs: Propositional Logic: Proposition, First order logic, Basic logical operation, truth tables, tautologies, Contradiction, kinds of conditional: converse, inverse, contrapositive. Algebra of Proposition, logical implications, logical equivalence, Universal and existential quantifiers. Translating English Statements into Propositions, Logical Inference.
Combinatorics: Introduction, Permutation and combination, Binomial Theorem, Recurrence Relations: Introduction, Linear recurrence relations with constant coefficients (Homogeneous recurrence relations and non-homogeneous recurrence relations), Generating functions: solution of recurrence relation using generating functions.

Unit- 4

Algebraic Structures: Binary operation and its properties, definition of algebraic structure, Semi Group, Monoid, Groups, Abelian group, properties of groups, Subgroup, cyclic groups, Homomorphism and isomorphism of Groups, Rings and Fields (definition and examples).

Unit- 5

Graph Theory: Introduction and basic terminology of graphs, Planer graphs, Multigraphs and weighted graphs, walks, paths and circuits, connected graphs, Shortest path in weighted graph, Introduction to Eulerian paths and circuits, Hamiltonian paths and circuits, Digraph, Graph coloring, chromatic number, Isomorphic and Homomorphic graphs, Matrix representation of graphs,

Course Outcomes Upon successful completion of the course,	
CO1:	Knowledge of sets, its operations, types and applications.
CO2:	Different relations and its properties. Terms related to functions.
CO3:	Propositional logic and its application and combinatorial analysis.
CO4:	Group theory and Ring theory.
CO5:	Different types of Graphs and its algorithms.

E-material
https://onlinecourses.nptel.ac.in/noc20_cs82/preview

Evaluation: Evaluation will be continuous and integral part of the class followed by final examination.
Essential- Students can use **scientific calculator** (without memory) in internal as well as end sem exam in this paper.

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							Mid I	Mid II (IA)		
PCC	BTC PCC 402	Analysis and Design of Algorithm	3	1	0	4	20	20	60	100

Prior knowledge of Data Structure and Algorithms is essential.
Course Objectives:
• To develop problem solving abilities using mathematical theories • To analyze the performance of algorithms • To apply algorithmic strategies while solving problems • To develop time and space efficient algorithms • To study algorithmic examples in concurrent and parallel environments

Unit- 1
Problem solving and Algorithmic
Analysis Asymptotic notations, lower bound and upper bound: Best case, worst case, average case analysis, classification of time complexities (linear, logarithmic etc)
Recurrences: Formulation and solving recurrence equations using Master Theorem, Proving correctness of algorithms.

Unit- 2
Divide and Conquer Strategy
Problem subdivision -Divide and Conquer: Binary search, Quick sort, Merge sort, Integer Arithmetic, Maximum sub-array, Master's theorem and its uses.
Greedy strategy:
Principle, control abstraction, time analysis of control abstraction, knapsack problem, Job scheduling algorithm, Single Source Shortest Path Dijkstra's.

Unit- 3
Dynamic Programming: Principle, control abstraction, time analysis of control abstraction, binomial coefficients, multistage graphs, 0/1 knapsack, All Pair Shortest Path - Floyd-Warshall, OBST, Bellman-Ford, sum of subset.

Unit-4
Backtracking Strategy
Principle, control abstraction, time analysis of control abstraction, 8-queen problem, graph coloring problem, sum of subsets problem and Hamiltonian cycle

Unit- 5

Branch and Bound Strategy

Principle, control abstraction, time analysis of control abstraction, strategies – FIFO, LIFO and LC approaches, knapsack problem, Branch and Bound using TSP.

Complexity Theory

Polynomial and non-polynomial problems, deterministic and non-deterministic algorithms, P-class problems, NP-class of problems, vertex cover, Maximum Clique and 3-SAT.

Essential Readings (Text Books) • Thomas H Cormen and Charles E.L Leiserson, "Introduction to Algorithms", The MIT Press; 4th edition, April 5, 2022. • Jon Kleinberg, Eva Tardos, "Algorithm Design", Pearson, 2nd edition, 2013. • Horowitz, Sahani, "Fund amentals of computer Algorithms", Galgotia. 2Nd Edition, 1998.
Suggested Readings (Reference Books) • Michael T. Goodrich, Roberto Tamassia, "Algorithm Design: Foundations, Analysis and Internet Examples", Wiley. • Gilles Brassard, Paul Bratley, "Fundamentals of Algorithmics", PHI.
E-material • https://www.guru99.com/design-analysis-algorithms-tutorial.html • https://onlinecourses.nptel.ac.in/noc19_cs47/preview
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Course Outcomes Upon successful completion of the course,	
CO1:	Measure the complexity of an algorithm in various cases and also prove its correctness.
CO2:	Explore the various sorting algorithm and different greedy methods.
CO3:	Learn all the different dynamic programming strategy.
CO4:	Explore the backtracking algorithm and its applications
CO5:	Various Branch and Bound algorithms with proper numerical explanations and other complexity theory.

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Category- Professional Core Courses **PCC**

Course Category	Course Code	Course Title	L	T	P	C	Sessional		ESE	Total
							Mid I	Mid II (IA)		
PCC	BTC PCC 403	Operating System	3	1	0	4	20	20	60	100

Prior knowledge of Computer Organization, Data Structures and Algorithms 1s essential
Course Objectives:
• To provide a grand tour of the major components of operating systems. • To introduce the motion of a process, threads and CPU scheduling • To explore inter process communication mechanisms, to introduce the critical-section problem and solutions which can be used to ensure the consistency of shared data. • To develop a description of deadlocks and a number of different methods for handling deadlocks in a computer system. • To explore various techniques of allocating memory to processes and explain the concepts of demand paging, page-replacement algorithms. • To describe the details of implementing local file systems and directory structures

Unit- 1

Introduction to Operating Systems: Introduction to Operating systems, Evolution of OS, Types of OS, Operating system components, O.S. Services, system calls. **System programs:** compiler, linker, loader.

Unit- 2

Process Management: Process Concept- Process states, Process control block, Threads- Introduction, Multithreading Models, POSIX / pthreads **Process Scheduling:** Basic Concepts, Scheduling Criteria, Scheduling Algorithms.

Unit- 3I

IPC and Process Synchronization: Inter process Communication mechanisms: Pipes, Shared memory, Message passing **Process Synchronization** : Introduction, Critical-Section Problem, Hardware Support for Synchronization, Mutex Locks, Semaphores, Synchronization problem: Reader-writer, producer- consumer problem, Dining Philosophers problem.**Deadlocks:** Introduction, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

Unit- 4

Memory Management Memory management: Introduction, Contiguous and non-contiguous, Swapping, Memory Allocation Strategies, Paging, Segmentation, Virtual Memory: Background, Demand paging, Page Replacement Policies, Thrashing

Unit- 5

I/O Management File Management: Concept of Files and Directories, File-System Structure, FileSystem Implementation, Directory Implementation, File Allocation Methods, FreeSpace Management. Disk Scheduling-Disk Scheduling policies like FIFO, SSTF, SCAN, C-SCAN. Case study: xv6 Operating System

Course Outcomes Upon successful completion of the course,	
CO1:	Learn about different Operating System and its components.
CO2:	Knowledge of process state and scheduling algorithms.
CO3:	Analyze IPC mechanisms and solutions of process synchronization for critical section problems. Identify a deadlock for a given system snapshot.
CO4:	Analyze the performance of memory management algorithms for a given problem.
CO5:	Analyze the concept of file and directories and its structure

Essential Readings (Text Books)

- Silberschatz, Galvin, Gagne, "Operating System Principles", 10th Edition - 2018, Wiley, ISBN 978- 1-118- 063330
- 2. Stallings W., "Operating Systems- internals and design principles", 9th Edition-2018, pearson, ISBN-13: 978- 013-467-0959.

Suggested Readings (Reference Books)

- Dhamdhere D., "Systems Programming and Operating Systems", Revised 2nd Edition- 2009, McGraw Hill, ISBN-13: 9780074635797
- Andrew S. Tanenbaum; Modern Operating Systems; Prentice Hall of India Publication; 4th Edition2015. ISBN-13: 978-0133-591620
- 3. H.M. Deitel, P. J. Deitel, D. R. Choffnes, “Operating Systems “, Pearson, 3rd Edition, ISBN 0131828274, 97801318282

E-material

- https://pdos.csail.mit.edu/6.828/2018/xv6/book-rev11.pdf
- https://onlinecourses.nptel.ac.in/noc21_cs72/preview

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Category- Professional Core Courses **PCC**

Course Category	Course Code	Course Title	L	T	P	C	Sessional		ESE	Total
							Mid I	Mid II (IA)		
PCC	BTC PCC 404	Software Engineering	2	1	0	3	20	20	60	100

Course Objectives:
1. To comprehend the principles of Software Engineering
2. To apply appropriate process model for specific software project development
3. To be acquainted with methods of capturing, specifying, and analyzing software requirements.
4. To apply Design principles to software project development
5. To comprehend the UML diagrams
6. To be acquainted with agile process model.

Unit- 1

The Software Product and Software Process

Software Product and Process Characteristics, Software Process Models: Linear Sequential Model, Prototyping Model, RAD Model, Evolutionary Process Models like Incremental Model, Spiral Model, Component Assembly Model, RUP and Agile processes. Software Process customization and improvement, CMM, Product and Process Metrics

Unit- 2

Software Design

The Software Design Process, Design Concepts and Principles, Software Modeling and UML, Architectural Design, Architectural Views and Styles, Use Case Diagrams - Class Diagrams - Interaction Diagrams - State chart Diagrams - Activity Diagrams - Package Diagrams - Component Diagrams – Deployment Diagrams - Diagram Organization- Diagram Extensions User Interface Design, Function oriented Design, SA/SD Component Based Design, Design Metrics.

Unit- 3

Requirement Elicitation, Analysis, and Specification

Functional and Non-functional requirements, Requirement Sources and Elicitation Techniques, Analysis Modeling for Function-oriented and Object-oriented software development, Use case Modeling, System and Software Requirement Specifications, Requirement Validation, Traceability

Unit- 4

Software Maintenance

Software Project Measurement Need and Types of Maintenance, Software Configuration Management (SCM), Software Change Management, Version Control, Change control and Reporting, Program Comprehension Techniques, Re-engineering, Reverse Engineering, Tool Support. Project Management Concepts, Feasibility Analysis, Project and Process Planning, Resources Allocations, Software efforts, Schedule, and Cost estimations, Project Scheduling and Tracking, Risk Assessment and Mitigation, Software Quality Assurance (SQA). Project Plan, Project Metrics.

Unit- 5

Software Analysis and Testing

Software Static and Dynamic analysis, Code inspections, Software Testing, Fundamentals, Software Test Process, Testing Levels, Test Criteria, Test Case Design, Test Oracles, Test Techniques, Black-Box Testing, White-Box Unit Testing and Unit, Testing Frameworks, Integration Testing, System Testing and other Specialized, Testing, Test Plan, Test Metrics, Testing Tools. Introduction to Object-oriented analysis, design and comparison with structured Software Engg.

Course Outcomes: Upon successful completion of the course,	
CO1:	▪ Learn about the various Software Models.
CO2:	▪ This unit explain the design concepts and various use case diagram.
CO3:	▪ Knowledge of Function-oriented and Object-oriented software development, Use case Modeling and system requirement.
CO4:	▪ This unit covers the software maintenance, Software efforts, Schedule, and Cost estimations, Project Scheduling and Tracking, Risk Assessment and Mitigation, Software Quality Assurance (SQA).
CO5:	▪ All the algorithms related to Software testing and analysis.

Essential Readings (Text Books)

- Pankaj Jalote ,"An Integrated Approach to Software Engineering", Narosa Pub, 2005
- Rajib Mall, "Fundamentals of Software Engineering" Second Edition, PHI Learning
- R S. Pressman ,"Software Engineering: A Practitioner's Approach", Sixth edition2006, McGraw-Hill.

Suggested Readings (Reference Books)

- Sommerville,"Software Enginerring",Pearson Education.
- Richard H.Thayer,"Software Enginerring & Project Managements", WileyIndia
- Waman S.Jawadekar,"Software Enginerring", TMH
- Bob Hughes, M.Cotterell, Rajib Mall " Software Project Management", McGrawHill

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- https://www.guru99.com/software-testing.html
- https://onlinecourses.nptel.ac.in/noc20_cs68/preview

Evaluation: Evaluation will be continuous and integral part of the class followed by final examination.

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Category- Professional Core Courses **PCC**

Course Category	Course Code	Course Title	L	T	P	C	Sessional		ESE	Total
							Mid I	Mid II (IA)		
PCC	BTC PCC 405	Computer Organization and Architecture	2	1	0	3	20	20	60	100

Course Objectives:
Students to be familiarize the basic principles of computer architecture, Design and Multi Processing, Types of data transfer, Concept of semi conductor memories which is useful for research work in field Computer System

Unit- 1 Computer architecture and organization, computer generations, von Neumann model, CPU organization, CPU organization, Register organization, Various CPU register, Register Transfer, Bus and Memory Transfers, Arithmetic, Logic and Shift micro-operations, Arithmetic logic shift unit.

Unit- 2 The arithmetic and logic unit, Fixed-Point representation: integer representation, signmagnitude, 1's and 2's complement and range, Integer arithmetic: negation, addition and subtraction, multiplication, division, Floating-Point representation, Floating-Point arithmetic, Hardwired micro-programmed control unit, Control memory, Micro-program sequence**.**

Unit- 3 Central Progressing Unit (CPU), Stack Organization, Memory Stack, Reverse Polish Notation. Instruction Formats, Zero, One, Two, Three- Address Instructions, RISC Instructions and CISC Characteristics, Addressing Modes, Modes of Transfer, Priority Interrupt, Daisy Chaining, DMA, Input-Output Processor (IOP).

Unit-4 Computer memory system, Memory hierarchy, main memory: RAM, ROM chip, auxiliary and associative memory, Cache memory: associative mapping, direct mapping, setassociative mapping, write policy, cache performance, Virtual memory: address space, memory space, address mapping, paging and segmentation, TLB, page fault, effective access time, replacement algorithm.

Unit- 5 Parallel Processing, Pipelining General Consideration, Arithmetic Pipeline, and Instruction Pipeline, Vector Operations, Matrix Multiplication, and Memory Interleaving, Multiprocessors, Characteristics of Multiprocessors.

Essential Readings (Text Books)

1. Morris Mano , "Computer System Organization " PHI
2. Alan Clements: "Computer Organization and Architecture", Cengage Learning
3. Subrata Ghosal: "Computer Architecture and Organization", Pearson
4. William stalling ,"Computer Architecture and Organization" PHI
5. M. Usha, T.S. Shrikant: "Computer System Architecture and Organization", Willey India
6. Chaudhuri, P.Pal: "Computer Organization and Design", PHI
7. Sarangi: "Computer Organization and Architecture",Mc- Graw Hills

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B.Tech. Second Year (IV semester)
Category- Laboratory courses **LC**

Course Category	Course Code	Course Title	L	T	P	C	Sessional		ESE	Total
							Mid I	Mid II (IA)		
LC	BTC LC 406	Laboratory-II (SE and ADA Lab)	0	0	4	2	20	20	60	100

Prior knowledge • Data Structure and Algorithms • Computer Programming and Problem Solving
Course Objectives:
• To apply various design strategies of algorithms. • To develop time and space efficient algorithms. • To compare different strategies and find exact solutions. • Decide a suitable design strategy to solve a real-world problem
Laboratory-II is a combination of Software Engineering and Analysis Design and Algorithm.

List of Experiment

Software Engineering Lab: - (1 credit)

1 Write down the problem statement for a suggested system of relevance.
2 Do requirement analysis and develop Software Requirement Specification Sheet (SRS) for suggested system.
3 To perform the function-oriented diagram: Data Flow Diagram (DFD) and Structured chart.
4 To perform the user ‘s view analysis for the suggested system: Use case diagram.
5 To draw the structural view diagram for the system: Class diagram, object diagram.
6 To draw the behavioral view diagram: State-chart diagram, Activity diagram

Analysis Design and Algorithm Lab : - (1 credit)

1. Write a program for Strassen’s Matrix Multiplication.
2. Write a program for Huffman coding.
3. Write a program for minimum spanning trees using Kruskal’s algorithm.
4. Write a program for minimum spanning trees using Prim’s algorithm.
5. Write a program for single sources shortest path algorithm.

6. Write a program for traveling salesman problem.
7. Write a program for Hamiltonian cycle problem.

Course Outcomes: Upon successful completion of the course,	
CO1:	Compare the performance of various algorithms using time and space complexity.
CO2:	Illustrate the performance of algorithms using amortized analysis.
CO3:	Apply different problem-solving strategies to solve computational problems.
CO4:	Determine the optimal solutions for various problems.
CO5:	Extrapolate the concept of object-oriented programming.

Essential Readings (Text Books)

- Thomas H Cormen and Charles E.L Leiserson, "Introduction to Algorithms", The MIT Press; 4th edition, April 5, 2022.
- Jon Kleinberg, Eva Tardos, "Algorithm Design", Pearson, 2nd edition, 2013.
- Horowitz, Sahani, "Fund amentals of computer Algorithms", Galgotia. 2Nd Edition, 1998.
- R S. Pressman ,"Software Engineering: A Practitioner's Approach", Sixth edition2006, McGraw-Hill.

Suggested Readings (Reference Books)

- Michael T. Goodrich, Roberto Tamassia, "Algorithm Design: Foundations, Analysis and Internet Examples", Wiley.
- Gilles Brassard, Paul Bratley, "Fundamentals of Algorithmics", PHI.
- Sommerville,"Software Enginerring",Pearson Education.

E-material

- https://www.guru99.com/design-analysis-algorithms-tutorial.html
- https://onlinecourses.nptel.ac.in/noc19_cs47/preview
- https://www.guru99.com/software-testing.html
- https://onlinecourses.nptel.ac.in/noc20_cs68/preview

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Category- Laboratory courses **LC**

Course Category	Course Code	Course Title	L	T	P	C	Sessional		ESE	Total
							Mid I	Mid II (IA)		
LC	BTC LC 407	Laboratory-III (Core Java and OS Lab)	0	0	4	2	20	20	60	100

Operating System Lab:- (1 credit) (Implement any 5)

1 Write a program to simulate use of Linux commands like cp, grep with the usage of fork() and exec() system calls. Also show the usage of wait(), getpid() and exit() system calls.
2 Write a program to implement scheduling algorithms – FCFS, SJF, Round Robin and Priority
3 Write a program to simulate inter process communication mechanism using pipes and redirection.
4 Write a program using pthreads to demonstrate the reader writer synchronization problem. Implement appropriate synchronization. Show the different results with and without synchronization.
5 Write a program to implement Banker's Algorithm for deadlock avoidance.
6 Write a program to simulate memory allocation techniques: First Fit, Best Fit, Next Fit and Worst Fit.
7 Write a to implement paging replacement algorithms : a) FCFS b) Least Recently Used (LRU) c) Optimal algorithm
8 Write a program to implement disk scheduling algorithms FIFO, SSTF, SCAN, C-SCAN

Core Java Lab:- (1 credit) (Implement any 5)

1 The Fibonacci sequence is defined by the following rule. The first 2 values in the sequence are 1, 1. Every subsequent value is the sum of the 2 values preceding it. Write a Java program that uses both recursive and nonrecursive functions to print the nth value of the Fibonacci sequence?
2 Write a Java program that prompts the user for an integer and then prints out all the prime numbers up to that Integer?
3 Write a Java program that checks whether a given string is a palindrome or not. Ex: MADAM is a palindrome?
4 Write a Java program for sorting a given list of names in ascending order?
5 Write a Java program to multiply two given matrices?
6 Write a Java program that reads a line of integers and then displays each integer and the sum of all integers. (use StringTokenizer class)?
7 Write a Java program that reads on file name from the user, then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes?