SYLLABUS

Department	Department of Computer Science	**Program**	BCA
Level	UG	**Semester**	III
Course Code		**Course Type**	Discipline Specific Elective (DSE)
Paper	1A	**Course Title**	Computer Graphics
Credit	4	**Session**	2026-2027

Course Outcomes

CO1. Understand the fundamentals of Computer Graphics.

CO2. Identify and explain various input and output devices.

CO3. Implement line drawing algorithms.

CO4. Analyze and implement circle generation techniques.

CO5. Apply ellipse generation algorithms.

CO6. Understand the fundamentals of three-dimensional computer graphics.

CO7. Analyze hidden surface problems in computer graphics.

CO8. Evaluate graphical algorithms and transformation techniques for solving practical computer graphics problems.

CO9. Develop problem-solving and visualization skills by applying computer graphics concepts to create and manipulate 2D and 3D graphical objects effectively.

UNIT 1	Content	Duration
1	Bhartiya Gyan Parampra:Historical Background of Computer Graphics. Contribution of following Bhartiya Vaigyanik in the field of Computer Graphics: Pingala - Chandah Śāstra - Binary Representation, Narasimha Raghavan, P. J. Narayanan, Subhasis Chaudhuri, Prof. T. A. Sarasvati Amma.	12
2	Introduction to Computer Graphics: Application of Computer Graphics, Interactive and Passive Graphics.Graphic Systems: Display Processor, Cathode Ray Tube (CRT), Random Scan vs Raster Scan, Color CRT Monitors, Direct View Storage Tubes, Flat Panel Display. Input-Output Devices: Input Devices, Trackball, Light Pen, Image Scanner, Output Devices, Plotters.	12
3	Scan Conversion a line: Scan Conversion Definition, Scan Converting a Point, Scan Converting a Straight Line, DDA Algorithm. Scan Conversion Circle: Defining a Circle, Defining a Circle using Polynomial Method, Defining a Circle using Polar Coordinates Method, Bresenham's Circle Algorithm, Midpoint Circle Algorithm. Scan Converting Ellipse: Scan converting a Ellipse, Polynomial Method, Trignometric Method, Midpoint Ellipse Algorithm.	12
4	Filled Area Primitives: Boundary Fill Algorithm, Flood Fill Algorithm, Scan Line Polygon Fill Algorithm.2D Transformations: Introduction of Transformation, Translation, Scaling, Rotation, Reflection, Shearing, Matrix Representation, Homogeneous Coordinates, Composite Transformation, Pivot Point Rotation.	12

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5	Animation: Animation, Application Areas of Animation, Animation Functions. 3D Computer Graphics: Three Dimensional Graphics, Three Dimensional Transformations, Scaling, Rotation, Rotation about Arbitrary Axis, Inverse Transformations, Reflection, Shearing Hidden Surfaces: Hidden Surface Removal, Back Face Removal Algorithm, Z-Buffer Algorithm, Painter's Algorithm, Scan Line Algorithm, Subdivision Algorithm.	12

Assessment Scheme

Component	Credit	Internal	External	Total
Theory	3	30	70	100
Practical	1	30	70	100
Total	**4**			**200**

Practical List

P1. Write a Program to draw basic graphics construction like line, circle, arc, ellipse and rectangle.

P2. Write a program of Translation, Rotation, and Scaling using Composite Transformation.

P3. Write a program to draw a Circle using midpoint implementation Method.

P4. Write a program to draw Bezier curve.

P5. Program to rotate a rectangle about its midpoint.

P6. Program to clip a line using Liang Barsky Method.

P7. Program to implement Standard Perspective Projection in 3-Dimensions.

P8. Program to implement Parallel Projection in 3-Dimensions.

P9. Write a Program to implement Digital Clock.

P10. Write a Program to draw animation using increasing circles filled with different colors and patterns.

P11. Write a Program control a ball using arrow keys.

P12. Write a Program to implement Bouncing Ball in vertical direction.

Reference Books

- Mukherjee, D. P.
- Fundamentals of Computer Graphics and Multimedia, PHI, 1998.
- Hearn: Computer Graphics, Pearson Education India, 2002.
- John Hughes, Andries van Dam, Morgan McGuire, David Sklar, James Foley: Computer Graphics: Principles and Practice, Addison-Wesley Professional, 3rd edition, 2013.
- MP Hindi Granth Akadami Books.
- Zhigang Xiang, Roy A. Plastock: Schaum's Outline of Computer Graphics, McGraw Hill, 2020.
- Desai, Apurva A: Computer Graphics, Prentice Hall India Learning Private Limited, 2008
- James D. Foley, Andries van Dam, Steven K. Feiner, John F. Hughes: Introduction Computer Graphics, Addison Wesley, 1993.

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SYLLABUS

Department	Department of Computer Science	**Program**	BCA
Level	UG	**Semester**	III
Course Code		**Course Type**	Discipline Specific Elective (DSE)
Paper	1B	**Course Title**	Software Engineering
Credit	4	**Session**	2026-2027

Course Outcomes

CO1. Understand the evolving role and changing nature of software.

CO2. Apply requirement elicitation and analysis techniques.

CO3. Analyze software architecture and design approaches.

CO4. Understand debugging techniques and analyze errors to improve software reliability.

CO5. Apply software engineering principles to real-world software projects to improve software quality, reliability, and maintainability.

UNIT 0	Content	Duration
1	The evolving role of software, changing nature of software, layered technology, a process framework, Process models: The waterfall model, incremental process models, evolutionary process models, the unified process	12
2	Software Requirements Engineering: Functional and non-functional requirements, the software requirements document, Requirements specification, Requirements engineering processes, Requirements elicitation and analysis, Requirements validation, Requirements management.	12
3	Design process and design quality, design concepts, the design model, software architecture, data design, architectural design, Basic structural modeling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, component diagrams, Cocomo Model, ER diagram, Time Line Chart	12
4	Testing Strategies: A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging.	12
5	Product metrics: Software quality, metrics for analysis model, metrics for design model, metrics for source code, metrics for testing, metrics for maintenance	12

Assessment Scheme

Component	Credit	Internal	External	Total
Theory	4	30	70	100

Reference Books

- N.S. Gill: Software Engineering, Khanna Publishing House, 2023
- Ian Somerville: Software Engineering, 9th edition, Pearson education, 2017.

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- Roger S Pressman, Bruce R. Maxim: Software Engineering A Practitioner's Approach, 8th edition, McGraw Hill Education, 2015.
- Books published by the Madhya Pradesh Hindi Granth Academy.
- Stephen Schach: Software Engineering 7th ed, McGraw-Hill, 2007.
- Hans van Vliet: Software Engineering: Principles and Practice, Wiley, 2010.

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Department	Department of Computer Science	**Program**	BCA
Level	UG	**Semester**	III
Course Code		**Course Type**	Core Course
Paper	NA	**Course Title**	Data Communication And Computer Network
Credit	6	**Session**	2026-2027

Course Outcomes

CO1. Understand the fundamentals of computer networks.

CO2. Identify and compare network topologies

CO3. Explain the theoretical basis of data communication.

CO4. Evaluate transmission media selection factors.

CO5. Analyze network communication methods.

CO6. Analyze the Network Layer operations.

CO7. Apply networking concepts to real-world communication systems.

CO8. Evaluate network performance and communication requirements.

UNIT 1	Content	Duration
1	Bhartiya Gyan Parampra: Oral communication systems (Shruti and Smriti), Messenger systems (Doot Pranali), Panini's grammar system (Ashtadhyayi), Vedic chanting methods (Padapatha, Krama Patha, Ghana Patha). Network goals and application, Network Structure, Network Services, Example of Networks and Network Standardization, Networking Models: Centralized, Distributed and collaborative. Network Topologies: Bus, Star, Ring, Tree, Hybrid. Selection and Evaluation Factors. NIC (Network Interface Card), Modem, Repeater, Hub, Bridge, Switch, Router, Gateway, Wireless Access Point (WAP), Firewall.	12
2	Theoretical Basis for Data Communication, Transmission Media, Twisted Pair (UTP, STP), Coaxial Cable, Fiberoptics: Selection and Evaluation factors. Line of Sight Transmission, Communication Satellites. Analog and Digital Transmission. Transmission and Switching, Frequency division and Time division Multiplexing, STDM, Circuit Switching, Packet Switching and Message Switching.	12
3	Brief Overview of LAN (Local Area Network): Classification. Brief Overview of Wide Area Network (WAN). Salient features and differences of LAN with emphasis on Media, Topology, Speed of Transmission, Distance, Cost. Terminal Handling, Polling, Token passing, Contention. IEEE Standards: their need and development. IP Address, IPv4, IPv6, Private IP, Public IP, MAC Address, Port, Domain Name, DNS.	12
4	Open System: What is an Open System? Network Architectures, ISOOSI Reference Model, Layers: Application, Presentation, Session, Transport, Network, Data Link & Physical. Physical Layer: Transmission, Bandwidth, Signaling Devices used, Media Type. Data Link Layer: Addressing, Media Access Method, Logical Link Control, Basic Algorithms/Protocols.	12

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5	Network Layer: Routing, Fewest-Hops Routing, Type of Service Routing, Updating Gateway Routing Information. Brief Overview of Gateways, Bridge and Routers, Gateway Protocols, Routing Daemons, OSI and TCP/IP Model, TCP/IP and Ethernet. The Internet: The Structure of the Internet, The Internet Layers, Internet Work Problems, Internet Standards.	12

Assessment Scheme

Component	Credit	Internal	External	Total
Theory	4	30	70	100
Practical	2	30	70	100
Total	**6**			**200**

Practical List

P1. Display IP configuration of the computer — ipconfig

P2. Display detailed network configuration — ipconfig /all

P3. Test connectivity with another device/website — ping google.com

P4. Find the IP address of a domain name — nslookup google.com

P5. Trace the route to a website — tracert google.com

P6. Display the computer/host name — hostname

P7. Display the ARP table — arp -a

P8. Display active network connections — netstat

P9. Display the routing table — route print

P10. In a Simulator design various topologies and varify using IPCONFIG and PING command.

P11. Identify and study networking devices such as hub, switch, router, modem, repeater, gateway, and Network Interface Card (NIC).

P12. Draw and compare Bus, Star, Ring, Tree, and Hybrid topologies and analyze their advantages and disadvantages.

P13. Create and configure a Local Area Network (LAN) between computers and test communication.

P14. Configure IP addresses (static and dynamic) and verify communication using commands such as ping and ipconfig.

P15. Configure and test a small peer-to-peer network between two or more computers.

P16. Basic configuration of router and switch settings in a networking environment.

P17. Configure basic password protection, firewall settings, and access permissions.

P18. Design a computer network for a school, office, library, or laboratory with proper topology and media selection.

P19. Compare speed, cost, topology, transmission media, and coverage area of LAN and WAN networks through observation and report preparation.

P20. Conduct a survey of an institution or ISP to study the type of network infrastructure and communication media used. Submit findings in a short report.

P21. Design a small network for an institution (school, office, or library) selecting appropriate topology, transmission media, and networking devices with justification.

Reference Books

- Behrouz A. Forouzan: Data Communications and Networking, McGraw-Hill, 2007.
- William stallings: Data and Communication Network, Pearson Education India, 2007.
- Madhya Pradesh Hindi Granth Akadami Books

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- Andrew S. Tanenbaum: Computer Networks, Prentice Hall PTR, 2003.
- Douglas E Comer: Computer Networks and Internets, Pearson, 2015.
- Uyless D. Black: Computer Networks, Prentice Hall
- 2nd edition, 1993.

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Department	Department of Computer Science	**Program**	BCA
Level	UG	**Semester**	III
Course Code		**Course Type**	Minor
Paper	NA	**Course Title**	Optimization Techniques
Credit	4	**Session**	2026-2027

Course Outcomes

CO1. Formulate real life problems into linear programming problem.

CO2. Apply the simplex method to find an optimal solution.

CO3. Find optimal solution of transportation model.

CO4. Analyze optimality conditions in transportation problems.

CO5. Apply Linear Programming and Transportation models to real-world problems such as production planning, transportation scheduling, cost minimization, and profit maximization.

UNIT 0	Content	Duration
1	Bhartiya Gyan Parampra: Contribution and biography of following Bhartiya Ganitagya in Optimization Technique: Dr. Narendra Karmarkar, Dr. P. C. Mahalanobis, Dr. C. R. Rao	2
2	Linear Programming Problems: 2.1 Basic concepts of LPP 2.2 Mathematical formulation of LPP 2.3 Solving LPP 2.3.1 Corner Point Method 2.3.2 Graphical Method 2.4 Simplex method for solving LPP 2.4.1 Maximization Problem 2.4.2 Minimization or Dual Problem 2.4.3 Mixed Constraints Problem	13
3	Assignment problem. Hungarian method, Sequencing Models: Johnson's Algorithm for processing n jobs through 2 machines, Algorithm for processing n jobs through 3 or more machines, Processing 2 jobs through n machines.	15
4	Transportation Problems: 4.1 Balanced and unbalanced problems 4.2 Optimality conditions 4.3 Methods to find starting solution and optimal solution 4.4 Algorithm for solving transportation problem 4.5 Northwest-Corner method 4.6 Least cost method, Vogels Approximation Method.	15
5	Applications of Linear Programming: 5.1 Manufacturing and Production Planning 5.2 Supply Chain Management 5.3 Transportation and Logistics 5.4 Allocation problems 5.5 Telecommunications and Network Design 5.6 Agriculture and Food Production 5.7 Healthcare and Medicine	15

Assessment Scheme

Component	Credit	Internal	External	Total
Theory	4	30	70	100

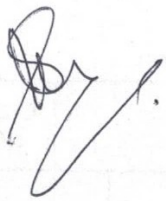
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- Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali: Linear Programming and Network Flows, 2nd Ed., John Wiley and Sons, India, 2004.
- S. K. Sharma: Linear Programming, Cyber Tech Publications, 2009.
- S. D. Sharma - Operations Research, Kedar Nath Publication, 2012.
- Kanti Swarup, P.K. Gupta and Manmohan: Operations Research, Sultan Chand and Sons, New Delhi, 2014.



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