MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL
(Formerly West Bengal University of Technology)
Syllabus of B. Sc. in IT
(Effective from 2023-24 Academic Sessions)
Semester: VII

SUBJECT NAME: Computer Graphics
SUBJECT CODE: – BSCITM701

SUBJECT NAME: Computer Graphics lab
SUBJECT CODE: BSCITM791
MARKS: 100 (Theory: 70 + Internal: 30) + 100 (Practical: 40 internal + 60 external)
CREDIT: 5 (L:3, P:2)
Contact Hours: Theory-4 hrs /Week Practical- 6 hrs/week

AIM OF THE COURSE:

This course prepares students for activities involving the design, development, and testing of modeling, rendering, and animation solutions to a broad variety of problems found in entertainment, sciences, and engineering.

COURSE OBJECTIVES:

After completing the course, students should be able to:

1. Understand hardware system architecture for computer graphics, including graphics pipeline, frame buffers, and graphic accelerators/co-processors.
2. Design and implement model and viewing transformations.
3. Apply underlying algorithms and mathematical concepts supporting computer graphics such as 3D homogeneous matrices, cross and dot products, and hidden surface detection/removal.
4. Select and use models for lighting and shading.
5. Apply different surface models, including geometric, polygonal, hierarchical, mesh, curves, and splines.
6. Understand current trends in computer graphics and quickly learn new graphics concepts and APIs.

PREREQUISITES:

Basic knowledge of 2D and 3D geometry, matrices, and programming languages.

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CO No.	Course Outcome
CO1	Demonstrate understanding of basic computer graphics concepts, coordinate representation, pixel-based systems, and common input/output devices.
CO2	Apply fundamental graphics algorithms for drawing points, lines, circles, ellipses, polygons, and filled areas using efficient computational techniques.
CO3	Perform 2D viewing operations including window–viewport transformation and implement line, polygon, and text clipping algorithms.
CO4	Apply 2D and 3D geometric transformations such as translation, rotation, scaling, shearing, reflection, and projections using homogeneous coordinates.
CO5	Analyze and implement 3D viewing, surface detection algorithms, illumination models, and color models for realistic rendering.
CO6	Understand and apply advanced computer graphics concepts including curves, surfaces, and basic animation techniques.

Unit No.	Unit Title	Mapped COs
Unit 1	Basics of Computer Graphics	CO1
Unit 2	Graphics Primitives	CO2
Unit 3	2D Viewing	CO3
Unit 4	2D and 3D Transformations	CO4
Unit 5	3D Transformation and Viewing	CO5, CO6

DETAILED SYLLABUS:

UNIT 1 – Basics of Computer Graphics
Introduction to coordinate representation and pixel graphics. Output devices including CRT, raster scan and random scan systems, color CRT monitors, DVST, flat panel displays, video controllers, and raster scan display processors. Graphics input devices: keyboard, mouse, trackball, space ball, joysticks, data glove, light pen, digitizer, image scanners, touch panels, and voice systems. Overview of graphics software.
Hours: 8 **Marks:** 10

UNIT 2 – Graphics Primitives
Point and line drawing, line drawing algorithms: simple, DDA, Bresenham's, midpoint circle and ellipse algorithms. Polygon drawing, representation, conventional methods, real-time scan conversion, run-length encoding. Filled area primitives: scan-line polygon fill algorithm, flood-fill algorithm, character generation, antialiasing.
Hours: 12 **Marks:** 15

UNIT 3 – 2D Viewing

Viewing pipeline, window-to-viewport transformation, 2D clipping, Cohen-Sutherland line clipping, Liang-Barsky algorithm, polygon clipping using Sutherland-Hodgeman and Weiler-Atherton methods, text clipping.

Hours: 15 **Marks:** 15

UNIT 4 – 2D and 3D Transformations

Scaling, rotation, translation, shearing, reflection, homogeneous coordinates, composite transformations, affine transformations. 3D concepts, projections: perspective, orthographic, axonometric, and oblique projections.

Hours: 12 **Marks:** 15

UNIT 5 – 3D Transformation and Viewing

Curves and surfaces: spline representations, Bezier curves, B-spline curves. Visible surface detection: back-face detection, depth-buffer, Z-buffer, scan-line method. Illumination models: ambient, diffuse, specular reflection, Phong model, Warn model. Half-toning and dithering techniques. Color models: RGB, YIQ, HSV, CMY. Key-frame animation.

Hours: 13 **Marks:** 15

PRACTICAL

Skills to be Developed:
Intellectual Skills:

- Apply programming constructs in problem-solving.
- Implement multiple solutions for a single problem.
- Debug programs and analyze different types of errors (syntax, semantic, runtime, logical).
- Follow steps in program development: problem definition, analysis, logic design, coding, testing, maintenance.

Motor Skills:

- Proper handling of computer systems.

List of Practical Experiments:

1. Implement DDA algorithm for line drawing.
2. Implement Bresenham's algorithm for line drawing.
3. Implement midpoint circle drawing algorithm.
4. Implement Bresenham's circle drawing algorithm.
5. Implement flood-fill algorithm for polygon filling.
6. Implement scan-line algorithm for polygon filling.
7. Write programs for 2D transformations: scaling, rotation, shearing, translation.
8. Write program for rotation about an arbitrary point.
9. Implement Cohen-Sutherland line clipping algorithm.
10. Implement midpoint subdivision algorithm for line clipping.
11. Implement Sutherland-Hodgeman algorithm for polygon clipping.
12. Write programs to draw curves using Bezier and B-spline algorithms.
13. Any graphics program can be implemented in the lab (e.g., animation, fractals).

TEXTBOOKS / REFERENCE BOOKS:

1. D. Hearn & P. Baker, *Computer Graphics C Version*, Pearson Education
2. Foley & van Dam, *Computer Graphics*, Pearson Education
3. Hearn & Baker, *Computer Graphics with OpenGL*, Pearson
4. Rogers, *Procedural Methods for Computer Graphics*, TMH
5. R.K. Maurya, *Computer Graphics with Virtual Reality Systems*, Wiley-India
6. Sinha & Udai, *Computer Graphics*, TMH

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SUBJECT NAME: Research Methodology
COURSE CODE: BSCITM702
CREDIT: 5
MAXIMUM MARKS: 100

AIM OF THE COURSE:

This course aims to provide students with a comprehensive understanding of research methodology, including designing, conducting, analyzing, and reporting research, with a focus on applications in Information Technology.

COURSE OBJECTIVES:

After completing this course, students will be able to:

1. Understand the concepts, objectives, and importance of research and research methodology.
2. Develop skills to design research effectively using appropriate research designs and experimental principles.
3. Conduct literature review, formulate research hypotheses, and understand citation and plagiarism standards.
4. Apply sampling techniques and data collection methods for primary and secondary data.
5. Analyze data using statistical methods including t-tests, chi-square, and ANOVA.
6. Prepare and present research reports in a professional and structured format.

CO No.	Rewritten Course Outcome (Bloom's Taxonomy)
CO1	**Explain** the fundamental concepts, types, objectives, and importance of research, and **identify** the components of a well-structured research report.
CO2	**Differentiate** among various research designs and **apply** suitable exploratory, descriptive, or experimental approaches to a research problem.
CO3	**Conduct** effective literature reviews, **evaluate** academic sources, and **formulate** appropriate research hypotheses using proper citation standards.
CO4	**Select** appropriate sampling techniques and **use** suitable methods for collecting primary and secondary data.
CO5	**Analyze** research data using descriptive and inferential statistical tools such as t-tests, chi-square tests, and ANOVA.
CO6	**Create** well-structured research reports and **deliver** effective presentations to communicate research findings clearly.

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Unit No.	Unit Title	Mapped COs
Unit 1	Introduction to Research	CO1
Unit 2	Research Design	CO2
Unit 3	Literature Review and Formulating Hypothesis	CO3
Unit 4	Methods of Sampling and Data Collection	CO4
Unit 5	Data Analysis Techniques	CO5
Unit 6	Report Writing and Presentation	CO6

DETAILED SYLLABUS:

Unit 1 – Introduction to Research
Definition of research and research methodology, objectives of research, motivations and importance of research, types of research, steps in the research process, criteria of good research, relevance of research in Information Technology. Report writing: layout of research report, types of report, essential qualities of research report.
Hours: 15 **Marks:** 10

Unit 2 – Research Design
Meaning and need for research design, features of a good research design, important concepts relating to research design. Different research designs: exploratory, descriptive, and experimental. Basic principles of experimental designs.
Hours: 15 **Marks:** 10

Unit 3 – Literature Review and Formulating Hypothesis
Purpose and process of literature review, sources of literature including journals, books, databases, conference proceedings. Plagiarism and citation standards (APA, IEEE). Definition and basic concepts of hypothesis testing.
Hours: 15 **Marks:** 15

Unit 4 – Methods of Sampling and Data Collection
Sampling techniques: probability and non-probability sampling. Collection of primary data through observation, interviews, questionnaires, and schedules. Sources of secondary data.
Hours: 10 **Marks:** 15

Unit 5 – Data Analysis Techniques
Introduction to statistics: descriptive and inferential statistics. Techniques for data analysis including t-tests, chi-square tests, and ANOVA.
Hours: 10 **Marks:** 10

Unit 6 – Report Writing and Presentation
Significance of report writing, steps in report writing, types of reports, and report layout. Techniques for effective presentation of research findings.
Hours: 10 **Marks:** 10

SUGGESTED READINGS:

Sl. No.	Author(s)	Title	Publisher
1	C.R. Kothari	Research Methodology	New Age International Publishers
2	Prof. M.V. Kulkarni	Research Methodology	Everest Publishing House
3	Wilkinson & Bhandarkar	Methodology and Techniques of Social Research	Himalaya Publishing House
4	William G. Zikmund	Business Research Methods	Cengage Learning
5	Donald Cooper & Pamela Schindler	Business Research Methods	McGraw Hill

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SUBJECT NAME: Theory of Computation
COURSE CODE: BSCITM703-A
CREDIT: 4
CONTACT HOURS/WEEK: 4L
MARKS: 100 (Theory: 70 + Internal: 30)

AIM OF THE COURSE:

This course focuses on the basic theory of computer science and formal methods of computation, including automata theory, formal languages, grammars, and Turing Machines.

COURSE OBJECTIVES:

After completing this course, students should be able to:

CO No.	Course Outcome (CO)
CO1	Understand core concepts of formal languages and automata.
CO2	Design DFAs, NFAs, PDAs, and Turing Machines for language recognition.
CO3	Translate between regular expressions and automata, and understand their limitations.
CO4	Construct grammars and normalize them.
CO5	Grasp computational boundaries via Turing Machines and undecidability.
CO6	Apply theoretical models to basic software systems and computational tasks.

Unit No.	Unit Title	Mapped COs
Unit 1	Foundations: Alphabets, Languages, and Automata	**CO1**
Unit 2	Finite Automata	**CO2**
Unit 3	Regular Expressions and Regular Languages	**CO3**
Unit 4	Context-Free Grammars and Simplification	**CO4**
Unit 5	Push Down Automata (PDA)	**CO2**, **CO4**
Unit 6	Turing Machines (TM)	**CO2**, **CO5**

Unit 7	Undecidability and Complexity	**CO5**, **CO6**

PREREQUISITES:

Basic knowledge of computer fundamentals, problem-solving skills, and elementary mathematics including sets, logic, functions, and relations.

DETAILED SYLLABUS:

UNIT 1 – Foundations: Alphabets, Languages, and Automata
Basic idea of alphabets, strings, and languages; operations on strings and languages; Chomsky hierarchy of languages; introduction to automata theory and applications.
Hours: 5 **Marks:** 5

UNIT 2 – Finite Automata
Deterministic Finite Automata (DFA): state transition diagram, table, and language recognition. Nondeterministic Finite Automata (NFA), ε-NFA and conversion to DFA. Minimization of Finite Automata. FA with output – Moore and Mealy machines, equivalence and applications.

Hours: 10 **Marks:** 10

UNIT 3 – Regular Expressions and Regular Languages
Regular expressions: definition, operators, precedence, and laws. Kleene's Theorem, Arden's Theorem and applications. Conversion of RE to FA and vice versa. Equivalence of REs and FAs, Pumping Lemma, and closure properties.
Hours: 10 **Marks:** 15

UNIT 4 – Context-Free Grammars and Simplification
Regular grammars – right-linear and left-linear and equivalence to FA. Context-Free Grammar: definition, derivations, parse trees, ambiguity. Simplification: useless symbols, ε-productions, unit productions. Normal forms: CNF, GNF; closure and decision properties.
Hours: 10 **Marks:** 15

UNIT 5 – Push Down Automata (PDA)
Definition and language acceptance by PDA. Acceptance by final state and empty stack. Deterministic PDA. Equivalence of PDA and CFG; CFG to PDA conversion.
Hours: 10 **Marks:** 10

UNIT 6 – Turing Machines (TM)
Turing Machine: definition, representation, and language acceptance. Instantaneous descriptions, computable functions, universal TM. Variants of TM (multi-tape, non-deterministic, etc.).
Hours: 10 **Marks:** 10

UNIT 7 – Undecidability and Complexity
Halting problem, undecidability, problems related to TMs. Recursive and RE languages.

Introduction to complexity classes: P, NP, NP-complete (basic concept + example).
Hours: 5 **Marks:** 5

TEXTBOOKS / REFERENCE BOOKS:

Sl. No.	Author(s)	Title	Publisher
1	Hopcroft, Motwani, Ullman	Introduction to Automata Theory, Languages and Computation	Pearson
2	Peter Linz	An Introduction to Formal Languages and Automata	Jones & Bartlett
3	K.L.P. Mishra, N. Chandrasekaran	Theory of Computation	PHI
4	Adesh K. Pandey	Automata Theory & Formal Languages	Katson Books
5	Vivek Kulkarni	Theory of Computation	Oxford University Press
6	Nagpal	Formal Language and Automata Theory	Oxford

SUBJECT NAME: Cloud Computing
SUBJECT CODE: BSCITM703-B
CREDIT: 4
CONTACT HOURS/WEEK: 4L
TOTAL MARKS: 100 (Theory: 70, Internal: 30)

COURSE OBJECTIVE:

The objective of the course "Cloud Computing" is to introduce students to the fundamental concepts, architecture, and service models of cloud computing. The course aims to develop a comprehensive understanding of cloud infrastructure, deployment models, virtualization, cloud storage, and security. It also provides insight into practical applications and modern tools used in cloud environments.

COURSE OUTCOME:

CO No.	Course Outcome (CO)
CO1	Understand the basic concepts, characteristics, and evolution of cloud computing.
CO2	Explain various service models (IaaS, PaaS, SaaS) and deployment models (Public, Private, Hybrid, Community).

CO3	Analyze the role of virtualization in cloud computing and explore virtual machine provisioning.
CO4	Describe cloud storage mechanisms, data management, and backup techniques.
CO5	Identify cloud security risks and understand security practices and compliance.
CO6	Evaluate real-world cloud platforms and applications (e.g., AWS, Microsoft Azure, Google Cloud).

Unit No.	Unit Title	Mapped COs
Unit 1	Foundations: Alphabets, Languages, and Automata	**CO1**
Unit 2	Finite Automata	**CO2**
Unit 3	Regular Expressions and Regular Languages	**CO3**
Unit 4	Context-Free Grammars and Simplification	**CO4**
Unit 5	Push Down Automata (PDA)	**CO2**, **CO4**
Unit 6	Turing Machines (TM)	**CO2**, **CO5**
Unit 7	Undecidability and Complexity	**CO5**, **CO6**

DETAILED SYLLABUS:

Module I:
Introduction to Cloud Computing – Definition, History, Benefits, Characteristics (On-demand, Elasticity, Scalability), Challenges; Traditional Computing vs Cloud Computing; Use cases and applications of cloud computing; Overview of grid computing and utility computing.
Hours: 5 **Marks:** 5

Module II:
Cloud Service Models – Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS); Comparison and use cases of each model; Introduction to XaaS (Anything as a Service).
Hours: 5 **Marks:** 5

Module III:
Cloud Deployment Models – Public Cloud, Private Cloud, Hybrid Cloud, Community Cloud; Comparison of deployment models; Use cases and examples; Service-level agreements (SLAs).
Hours: 10 **Marks:** 10

Module IV:
Virtualization in Cloud Computing – Introduction to virtualization; Types of virtualization

(Server, Storage, Network); Hypervisors: Type 1 and Type 2; Virtual Machine (VM) provisioning and management; Role of virtualization in enabling the cloud.
Hours: 10 **Marks:** 15

Module V:
Cloud Storage and Data Management – Storage types: Object storage, Block storage, File storage; Cloud databases; Data redundancy and replication; Backup and disaster recovery in the cloud.
Hours: 10 **Marks:** 10

Module VI:
Cloud Security and Compliance – Threats in cloud environments; Data privacy and protection; Identity and access management (IAM); Compliance standards: ISO, HIPAA, GDPR; Security best practices.
Hours: 10 **Marks:** 15

Module VII:
Cloud Platforms and Case Studies – Overview of major cloud providers (AWS, Microsoft Azure, Google Cloud); Services and pricing models; Real-world case studies and applications in education, healthcare, and e-governance.
Hours: 10 **Marks:** 10

SUGGESTED READING:

1. *Cloud Computing: Principles and Paradigms* by Rajkumar Buyya et al. – Wiley
2. *Cloud Computing: A Practical Approach* by Anthony T. Velte, Toby J. Velte, Robert Elsenpeter – McGraw-Hill
3. *Mastering Cloud Computing* by Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi – McGraw-Hill
4. *Cloud Computing Bible* by Barrie Sosinsky – Wiley India
5. *Amazon Web Services in Action* by Michael Wittig and Andreas Wittig – Manning
6. *Architecting Cloud Computing Solutions* by Kevin L. Jackson – Packt Publishing