

# COURSE STRUCTURE

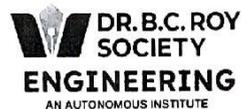
*for*

## B.TECH. DEGREE

*in*

### COMPUTER SCIENCE & DESIGN

*(Applicable from the academic session 2024-2025)*



**Dr. B. C. Roy Engineering College**

*An Autonomous Institution*

*Approved by: All India Council for Technical Education (AICTE)*

*Affiliated to: Maulana Abul Kalam Azad University of Technology, West Bengal  
(Formerly Known as -WBUT)*

**Jemua Road, Durgapur, West Bengal, India, 713206**

The first year course structure (Page 3 and Page 4) is unanimously accepted and approved in the first BoS meeting held in the Department of a) Physics, b) Chemistry, c) Mathematics, d) English, e) Electrical Engineering, f) Electronics and Communication Engineering, g) Computer Science and Engineering, h) Mechanical Engineering.

The BoS of CSD (Computer Science & Design) in its first meeting (held in the Department of CSD (Computer Science & Design) on 6th November 2024 has unanimously accepted and approved the four year course structure of CSD (Computer Science & Design).

  
TOD  
Computer Science & Design  
Dr. B. C. Roy Engineering College  
Durgapur, West Bengal

**Dr. B. C. Roy Engineering College, Durgapur**  
**(An Autonomous Institution)**  
**Syllabus for B. Tech in Computer Science & Design**

<b>Semester: IV</b>					
<b>Sl. No.</b>	<b>Course Type</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Engagement Type</b>	<b>Credit</b>
1	PC	CSD-401	Computer Graphics and Animation	T	3
2	PC	CSD-402	Design & Analysis of Algorithms	T	3
3	PC	CSD-403	Object Oriented Programming and Design	T	3
4	PC	CSD-404	Computer Networks	T	3
5	HM	CSD-405	Economics for Engineers (Humanities-II)	T	3
6	BS	CSD-406	Biology	T	3
7	PC	CSD-491	Computer Graphics and Animation Lab	P	2
8	PC	CSD-492	Design & Analysis of Algorithms Lab	P	2
9	PC	CSD-493	Object Oriented Programming and Design Lab	P	2
<b>TOTAL CREDIT</b>					<b>24</b>

**Dr. B. C. Roy Engineering College, Durgapur****(An Autonomous Institution)****Syllabus for B. Tech in Computer Science & Design**

<b>Semester-IV</b>			
<b>Subject/Course Name</b>	Computer Graphics & Animation	<b>Subject/Course Code</b>	CSD-401
<b>Contact Lecture/Week</b>	3	<b>Tutorial</b>	1
<b>Credit</b>	3	<b>Maximum Marks</b>	100
<b>Examination Scheme</b>			
<b>Internal Exam (CIA)</b>	40	<b>Final Exam (ESE)</b>	60
<b>Objective</b>			
1	To understand computer graphics, devices		
2	To understand algorithms for drawing line, circle, polygon, filling		
3	To understand algorithms for scaling, rotation, projection, viewing, clipping, transformations		
4	To understand and apply computer animations		
5			
<b>Prerequisite</b>			
1	Mathematical concept on Geometry, Matrix.		
2			
3			
4			
<b>Unit</b>	<b>Content</b>	<b>Hours/Unit</b>	
1	Overview of computer graphics, representing, preparing, presenting & interacting with pictures for presentations; RGB color model, storage tube graphics display, Raster/Random scan display, 3D viewing devices, Plotters, printers, digitizers, Light pens etc.; Active & Passive graphics devices; Computer graphics software. Scan conversion: Points & Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm.	9	
2	2D transformation & viewing: Basic transformations: translation, rotation, scaling; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection shear; Transformation of points, lines, parallel lines, intersecting lines. Viewing pipeline, Window to view port co-ordinate transformation, clipping operations, point clipping, line clipping, clipping circles, polygons & ellipse. Cohen and Sutherland line clipping, Sutherland-Hodgeman Polygon clipping & viewing.	9	

3	Curves: Curve representation, surfaces, designs, Bezier, Hermit curves, B-spline curves, Hidden surfaces: Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Painter's algorithm, scan-line algorithm; Hidden line elimination. Fractal - geometry. Color & shading models: Light & color model; interpolative shading model; Texture. Introduction to Ray-tracing: Human vision and color, Lighting, Reflection and transmission models.	8
4	Animation: Definition of Animation, Types of Animation, Cell Animation, Path Animation, 2D & 3D Animation Computer assisted Animation Techniques of Animation, Onion skinning, Motion cycling, Masking, Color cycling, Morphing Camera effects, Camera Location, Camera movement, Zones of vision Special effects, Methods of controlling the Animation, Procedural Animation, Tracking live action, Kinematics of controlling Animation, Tweening, Warping, Color dissolve Animation Software.	10

### Textbook and Reference Books

1	Hearn, Baker – “Computer Graphics (C version 2nd Ed.)” – Pearson education
2	Z. Xiang, R. Plastock – “Schaum's outlines Computer Graphics (2nd Ed.)” – TMH
3	D. F. Rogers, J. A. Adams – “Mathematical Elements for Computer Graphics (2nd Ed.)” – TMH
4	M. K. Pakhira – “Computer graphics, multimedia and Animation”, PHI.
5	The complete animation course by Chris Patmore Pub.-Baron's Educational Series. (New York)
6	Animation Unleashed by Ellen Bessen, Michael Weise Productions, 2008 (U.S.A)
7	The Animator's Survival Kit by Richard Williams, Arrar Straus & Giroux Pub.(U.S.A)
8	

### Course Outcome : On completion of the course students will be able to

CSD-401.1	Define / Explain the fundamental concepts / terms of Computer Graphics & Animation and its necessity / importance.
CSD-401.2	Apply the basic principles to solve simple model problems related to Computer Graphics & Animation in the real world.
CSD-401.3	Analyze a given Computer Graphics & Animation problem, design and implement a solution, and compute the output.
CSD-401.4	Identify sub-tasks / sub-systems , Perform Diagnostic assessment of a Computer Graphics & Animation problem, integrate / interconnect these sub-tasks to design an integrated working solution and Evaluate the solution.
CSD-401.5	Identify unsolved real world Computer Graphics & Animation problems, Synthesize pragmatic ideas and Create innovative solutions to such problems

**Course Articulation Matrix:**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>CO2</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>CO3</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>CO4</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>CO5</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>Average</b>	3	3	3	3	3	2	2	1	1	2	1	3

	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	3	3	3
<b>CO2</b>	3	3	3
<b>CO3</b>	3	3	3
<b>CO4</b>	3	3	3
<b>CO5</b>	3	3	3

**Dr. B. C. Roy Engineering College, Durgapur**  
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**Syllabus for B. Tech in Computer Science & Design**

<b>Semester-IV</b>			
<b>Subject/Course Name</b>	Design and Analysis of Algorithms	<b>Subject/Course Code</b>	CSD-402
<b>Contact Lecture/Week</b>	3	<b>Tutorial</b>	1
<b>Credit</b>	3	<b>Maximum Marks</b>	100
<b>Examination Scheme</b>			
<b>Internal Exam (CIA)</b>	40	<b>Final Exam (ESE)</b>	60
<b>Objective</b>			
1	The aim of this module is to learn how to develop efficient algorithms for simple computational tasks and reasoning about the correctness of them		
2	Through the complexity measures, different range of behaviours of algorithms and the notion of tractable and intractable problems will be understood.		
3			
4			
5			
<b>Prerequisite</b>			
1	To know data-structure and basic programming ability		
2			
3			
4			
<b>Unit</b>	<b>Content</b>	<b>Hours/Unit</b>	
1	Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behaviour; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters’ theorem	8	
2	Fundamental Algorithmic Strategies: Brute-Force, Greedy, Dynamic Programming, Branch and Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, Bin Packing, Knap Sack TSP. Heuristics –characteristics and their application domains.	8	
3	Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure,	7	

	Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.	
4	Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP complete and NP-hard. Cook’s theorem, Standard NP-complete problems and Reduction techniques.	11
5	Advanced Topics: Approximation algorithms, Randomized algorithms.	2

### Textbook and Reference Books

1	Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2	Fundamentals of Algorithms – E. Horowitz et al.
3	Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Michael T Goodrich and Roberto Tamassia, Wiley.
4	Algorithms -- A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley, Reading, MA
5	Design & Analysis of Algorithms, Gajendra Sharma, Khanna Publishing House (AICTE Recommended Textbook – 2018)
6	Algorithms Design and Analysis, Udit Agarwal, Dhanpat Rai
7	
8	

### Course Outcome : On completion of the course students will be able to

CSD-402.1	Define / Explain the fundamental concepts / terms of Design and Analysis of Algorithms and its necessity / importance.
CSD-402.2	Apply the basic principles to solve simple model problems related to Design and Analysis of Algorithms in the real world.
CSD-402.3	Analyze a given Design and Analysis of Algorithms problem, design and implement a solution, and compute the output.
CSD-402.4	Identify sub-tasks / sub-systems , Perform Diagnostic assessment of a Design and Analysis of Algorithms problem, integrate / interconnect these sub-tasks to design an integrated working solution and Evaluate the solution.
CSD-402.5	Identify unsolved real world Design and Analysis of Algorithms problems, Synthesize pragmatic ideas and Create innovative solutions to such problems

### Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	2	1	1	2	1	3
CO2	3	3	3	3	3	2	2	1	1	2	1	3
CO3	3	3	3	3	3	2	2	1	1	2	1	3
CO4	3	3	3	3	3	2	2	1	1	2	1	3
CO5	3	3	3	3	3	2	2	1	1	2	1	3
Average	3	3	3	3	3	2	2	1	1	2	1	3

	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>3</b>

**Dr. B. C. Roy Engineering College, Durgapur****(An Autonomous Institution)****Syllabus for B. Tech in Computer Science & Design**

<b>Semester-IV</b>			
<b>Subject/Course Name</b>	Object Oriented Programming and Design	<b>Subject/Course Code</b>	CSD-403
<b>Contact Lecture/Week</b>	3	<b>Tutorial</b>	Nil
<b>Credit</b>	3	<b>Maximum Marks</b>	100
<b>Examination Scheme</b>			
<b>Internal Exam (CIA)</b>	40	<b>Final Exam (ESE)</b>	60
<b>Objective</b>			
1	Write programs using objects & classes.		
2	Develop programs to create and destroy the objects using constructors and Destructors.		
3	Use existing operators for different meanings in Operator Overloading concept.		
4	Using reusability concept through Inheritance concept.		
5	Implement pointers for arrays, strings & object.		
6	Describe polymorphism, concepts, its types, virtual function & write program for the same.		
<b>Prerequisite</b>			
1	Interaction with DOS / Windows Operating System.		
2	Ability to develop logic / flow of simple problems.		
3	Basic Concepts of 'C'.		
4			
<b>Unit</b>	<b>Content</b>	<b>Hours/Unit</b>	
1	<b>Introduction to OOP:</b> Overview of OOP –Object oriented programming paradigms – Features of Object-Oriented Programming, Difference between OOP and other conventional programming – advantages and disadvantages, Class, object, relationships among objects, aggregation, links, relationships among classes association, aggregation, using, instantiation, meta-class, grouping constructs, abstraction, inheritance, Encapsulation, polymorphism.	5	

2	<p><b>Overview of Java:</b> Java Buzzwords, advantages of java, Java language specification API, JDK and IDE, byte-code &amp; JVM, data types, access specifiers, Operators – Control Statements – Programming Structures in Java – classes in Java – Constructors Methods -Access specifiers – Static members-Java Doc comments, garbage collection, basics of I/O operations – keyboard input using BufferedReader; Scanner classes.</p> <p><b>Control statements:</b> If-else statements, Switch statements, Conditional Expressions, Common mathematical functions, While, do-while and for loop, nested loops, Keyword break and continue. Java Methods (Defining, Scope, Passing and Returning Arguments, Type Conversion and Type and Checking, Built-in Java Class Methods),</p> <p><b>Objects &amp; Classes:</b></p> <p><b>2.1</b> Specifying a class, Defining member functions, Arrays within a class, Creating objects, memory allocation for objects, static data &amp; member function, Arrays of objects, objects as function argument.</p> <p><b>2.2</b> Class specifiers and their uses, distinction between structure (struct) of C and Class.</p>	5
3	<p><b>Constructors.</b></p> <p>1.1. Concept of Constructor (Default, Parameterized), Zero argument and explicit Overloaded Constructors.</p> <p><b>Function and Operator Overloading</b></p> <p>3.2 Function overloading, Inline member functions, constant member functions. 3.3 Operator overloading (overloading unary &amp; binary operators), rules for overloading operators. Type Conversion: Conversions from basic to class type, class to basic type, class to class type. Operators that cannot be overloaded.</p>	6
4	<p><b>Inheritance</b></p> <p><b>4.1.</b> Concepts of inheritance, Derived classes, Member declaration (Protected), Types of inheritance (Single, multilevel, hierarchical, Hybrid inheritance).</p> <p><b>4.2</b> Virtual base classes, Abstract classes, Constructors in derived classes. <b>4.3</b> Class within class, containership, IS A and HAS A relationship and their differences, Namespaces.</p>	6
5	<p><b>Polymorphism</b></p> <p><b>5.1.</b> Concepts of polymorphism, types of polymorphism, Overloading &amp; overriding, Overloading Virtual function, Static &amp; dynamic binding.</p> <p><b>5.2</b> Pure Virtual functions, Virtual Constructors and Destructors.</p>	5
6	<p><b>Exception Handling</b></p> <p>Concepts and uses of exception handler, the try /throw/ catch construct, uses and implementation of multiple exceptions, limitation of exception handling.</p>	4
7	<p><b>Package</b></p> <p>Organizing Classes and Interfaces in Packages, Package as Access Protection, Defining Package, CLASSPATH Setting for Packages, Making JAR Files for Library Packages Import and Static Import Naming Convention For Packages.</p>	4
8	<p><b>Array &amp; String :</b></p> <p>Defining an Array, Initializing &amp; Accessing Array, Multi –Dimensional Array, Operation on String, Mutable &amp; Immutable String, Using Collection Bases Loop for String, Tokenizing a String, Creating Strings using StringBuffer.</p>	4
9	<p><b>Thread :</b></p> <p>Understanding Threads , Needs of Multi-Threaded Programming ,Thread Life-Cycle, Thread Priorities ,Synchronizing Threads, Inter Communication of Threads ,Critical Factor in Thread –DeadLock.</p>	3

10	<p><b>GUI Programming</b>          Designing Graphical User Interfaces in Java, Components and Containers, Basics of Components, Using Containers, Layout Managers, AWT Components, Adding a Menu to Window, Extending GUI Features Using Swing Components, Java Utilities (java.util Package)</p> <p><b>JAVA FX controls and components:</b> Event Basics – Handling Key and Mouse Events. Controls: Labeled and Label, button, Checkbox, RadioButton, Textfield, TextArea, Combo Box, ListView, Scrollbar, Slider.</p> <p><b>Applet Programming</b>– Basics of applet programming, applet life cycle, difference between application &amp; applet programming, parameter passing in applets. <b>The Collection Framework :</b>          Collections of Objects, Collection Types, Sets , Sequence, Map, Understanding Hashing, Use of Array List &amp; Vector.</p>	6
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**Textbook and Reference Books**

1	Patrick Naughton, Herbert Schildt – The complete reference - Java2 – TMH
2	R.K Das – Core Java for Beginners; – VIKAS PUBLISHING
3	Deitel and Deitel – Java How to Program; – 6th Ed. – Pearson
4	E. Balagurusamy – Programming with Java: A Primer; – 3rd Ed. – TMH
5	
6	

**Course Outcome :** On completion of the course students will be able to

CSD-403.1	Define / Explain the fundamental concepts / terms of Object Oriented Programming and Design and its necessity / importance.
CSD-403.2	Apply the basic principles to solve simple model problems related to Object Oriented Programming and Design in the real world.
CSD-403.3	Analyze a given Object Oriented Programming and Design problem, design and implement a solution, and compute the output.
CSD-403.4	Identify sub-tasks / sub-systems , Perform Diagnostic assessment of a Object Oriented Programming and Design problem, integrate / interconnect these sub-tasks to design an integrated working solution and Evaluate the solution.
CSD-403.5	Identify unsolved real world Object Oriented Programming and Design problems, Synthesize pragmatic ideas and Create innovative solutions to such problems

**Course Articulation Matrix:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>CO2</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>CO3</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>CO4</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>CO5</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>Average</b>	3	3	3	3	3	2	2	1	1	2	1	3

	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>3</b>

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**Syllabus for B. Tech in Computer Science & Design**

<b>Semester-IV</b>			
<b>Subject/Course Name</b>	Computer Networks	<b>Subject/Course Code</b>	CSD-404
<b>Contact Lecture/Week</b>	3	<b>Tutorial</b>	1
<b>Credit</b>	3	<b>Maximum Marks</b>	100
<b>Examination Scheme</b>			
<b>Internal Exam (CIA)</b>	40	<b>Final Exam (ESE)</b>	60
<b>Objective</b>			
1	To develop an understanding of modern network architectures from a design and performance perspective.		
2	To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).		
3	To provide an opportunity to do network programming		
4	To provide WLAN measurement ideas.		
5			
<b>Prerequisite</b>			
1			
2			
3			
4			
<b>Unit</b>	<b>Content</b>	<b>Hours/Unit</b>	
1	Data communication Components: Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.	8	
2	Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA	8	
3	Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.	10	

4	Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.	6
	Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography.	4

### Textbook and Reference Books

1	An Engineering Approach to Computer Networks-S. Keshav, 2nd Edition, Pearson Education
2	Data Communications and Networking – Behrouz A. Forouzan. Third Edition TMH.
3	
4	

**Course Outcome :** On completion of the course students will be able to

CSD-404.1	Define / Explain the fundamental concepts / terms of Computer Networks and its necessity / importance.
CSD-404.2	Apply the basic principles to solve simple model problems related to Computer Networks in the real world.
CSD-404.3	Analyze a given Computer Networks problem, design and implement a solution, and compute the output.
CSD-404.4	Identify sub-tasks / sub-systems , Perform Diagnostic assessment of a Computer Networks problem, integrate / interconnect these sub-tasks to design an integrated working solution and Evaluate the solution.
CSD-404.5	Identify unsolved real world Computer Networks problems, Synthesize pragmatic ideas and Create innovative solutions to such problems

### Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>CO2</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>CO3</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>CO4</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>CO5</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>Average</b>	3	3	3	3	3	2	2	1	1	2	1	3

	PSO1	PSO2	PSO3
<b>CO1</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>3</b>

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**Syllabus for B. Tech in Computer Science & Design**

<b>Semester-IV</b>			
<b>Subject/Course Name</b>	Economics for Engineers (Humanities-II)	<b>Subject/Course Code</b>	CSD-405
<b>Contact Lecture/Week</b>	3	<b>Tutorial</b>	Nil
<b>Credit</b>	3	<b>Maximum Marks</b>	100
<b>Examination Scheme</b>			
<b>Internal Exam (CIA)</b>	40	<b>Final Exam (ESE)</b>	60
<b>Objective</b>			
1	Understand the role and scope of Engineering Economics and the process of economic decision making		
2	Understand the different concepts of cost and different cost estimation techniques		
3	Familiarization with the concepts of cash flow, time value of money and different interest formulas		
4	Appreciation of the role of uncertainty in future events and using different concepts from probability to deal with uncertainty		
5	Understand the concepts of Depreciation and Replacement analysis along with their methods of calculation		
6	Familiarization with the phenomenon of inflation and the use of price indices in engineering Economics		
7	Introduction to basic concepts of Accounting and Financial Management		
<b>Prerequisite</b>			
1	Mathematics		
2			
3			
4			
<b>Unit</b>	<b>Content</b>		<b>Hours/Unit</b>
1	Economic Decisions Making– Overview, Problems, Role, Decision making process. Engineering Costs & Estimation – Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring And Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life - Cycle Costs; Types Of Estimate, Estimating Models – Per Unit Model, Segmenting Model, Cost Indexes, Power Sizing Model, Improvement & Learning Curve, Benefits.		9

2	<p>Cash Flow, Interest and Equivalence: Cash Flow – Diagrams, Categories &amp; Computation, Time Value of Money, Debt repayment, Nominal &amp; Effective Interest.</p> <p>Cash Flow &amp; Rate of Return Analysis – Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; Internal Rate of Return, Calculating Rate of Return, Incremental Analysis; Best Alternative Choosing an Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity and Breakeven Analysis. Economic Analysis In The Public Sector -Quantifying And Valuing Benefits &amp; drawbacks.</p>	9
3.	<p>Inflation and Price Change – Definition, Effects, Causes, Price change with Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates. Present Worth Analysis:</p>	

	<p>End-Of- Year Convention, Viewpoint Of Economic Analysis Studies, Borrowed Money Viewpoint, Effect Of Inflation &amp; Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives.</p> <p>Uncertainty In Future Events - Estimates and Their Use in Economic Analysis, Range Of Estimates, Probability, Joint Probability Distributions, Expected Value, Economic Decision Trees, Risk, and Risk vs Return, Simulation, Real Options.</p>	9
4	<p>Depreciation - Basic Aspects, Deterioration &amp; Obsolescence, Depreciation And Expenses, Types of Property, Calculation, Depreciation Fundamentals, Depreciation And Capital Allowance Methods, Straight-Line Depreciation Declining Balance Depreciation, Common Elements of Tax Regulations for Depreciation and Capital Allowances. Replacement Analysis - Replacement Analysis Decision Map, Minimum Cost Life of a New Asset, Marginal Cost, Minimum Cost Life Problems. Accounting – Function, Balance Sheet, Income Statement, Financial Ratios, Capital Transactions, Cost Accounting, Direct and Indirect Costs, Indirect Cost Allocation.</p>	9

#### **Textbook and Reference Books**

1	James L.Riggs, David D. Bedworth, Sabah U. Randhawa : Economics for Engineers 4e , Tata McGraw Hill
2	Donald Newnan, Ted Eschembach, Jerome Lavelle: Engineering Economics Analysis, OUP
3	John A. White, Kenneth E. Case, David B. Pratt : Principle of Engineering Economic Analysis, John Wiley
4	Sullivan and Wicks: Engineering Economy, Pearson
5	R.Paneer Seelvan: Engineering Economics, PHI
6	Michael R Lindeburg : Engineering Economics Analysis, Professional Pub
7	
8	

**Course Outcome :** On completion of the course students will be able to

CSD-405.1	Define / Explain the fundamental concepts / terms of Economics for Engineers (Humanities-II) and its necessity / importance.
CSD-405.2	Apply the basic principles to solve simple model problems related to Economics for Engineers (Humanities-II) in the real world.
CSD-405.3	Analyze a given Economics for Engineers (Humanities-II) problem, design and implement a solution, and compute the output.
CSD-405.4	Identify sub-tasks / sub-systems , Perform Diagnostic assessment of a Economics for Engineers (Humanities-II) problem, integrate / interconnect these sub-tasks to design an integrated working solution and Evaluate the solution.
CSD-405.5	Identify unsolved real world Economics for Engineers (Humanities-II) problems, Synthesize pragmatic ideas and Create innovative solutions to such problems

**Course Articulation Matrix:**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>CO2</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>CO3</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>CO4</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>CO5</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>Average</b>	3	3	3	3	3	2	2	1	1	2	1	3

	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>3</b>

**Dr. B. C. Roy Engineering College, Durgapur**  
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**Syllabus for B. Tech in Computer Science & Design**

<b>Semester-IV</b>			
<b>Subject/Course Name</b>	Biology	<b>Subject/Course Code</b>	CSD-406
<b>Contact Lecture/Week</b>	3	<b>Tutorial</b>	Nil
<b>Credit</b>	3	<b>Maximum Marks</b>	100
<b>Examination Scheme</b>			

<b>Internal Exam (CIA)</b>	40	<b>Final Exam (ESE)</b>	60
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<b>Objective</b>	
1	This course imparts basic knowledge of biology, evolution, general awareness of environmental pollution effects and bio-engineering's aspects with cancer biology that provides the basic ideas among the engineering students for a better foundation of technical education.
2	To provide fundamentals among the upcoming young engineers and to carry out advanced technical and machinery research projects in biology and allied domains.
3	

<b>Prerequisite</b>	
1	Class-X-XII level knowledge of Biology and Bio-Environmental Science.
2	Undergraduate level introductory knowledge of Bio- Engineering.
3	

<b>Unit</b>	<b>Content</b>	<b>Hours/Unit</b>
1	Introduction to Biology in Engineering <ul style="list-style-type: none"> <li>• Science &amp; Engineering</li> <li>• Biology in Engineering</li> <li>• Instruments inspired by Biology (Camera and Aeroplane)</li> <li>• Major Biological discoveries of 18th to 21th Century.</li> </ul>	3
2	Cell Biology <ul style="list-style-type: none"> <li>• Cell types (Unicellular &amp; Multicellular, Prokaryotic &amp; Eukaryotic, Plant &amp; Animal Cell)</li> <li>• Cell organelles and their function (Cell Wall, Cell Membrane, Nucleus, Ribosome, Mitochondria and other cellular organelles)</li> <li>• Cell Division</li> <li>• Biomolecules- Carbohydrates, Proteins, Lipids and Nucleic Acids,</li> <li>• Biochemical qualitative tests for macromolecules</li> </ul>	5

3	<p>Microbiology</p> <ul style="list-style-type: none"> <li>• Classification of microorganisms, Bacteria, viruses, fungi, and protozoa.</li> <li>• Hierarchy classification of living organisms.</li> <li>• Growth curves and factors affecting growth.</li> <li>• Applications in Engineering (Industrial microbiology and Environmental Microbiology, Soil Engineering )</li> </ul>	3
4	<p>Genetical Engineering</p> <ul style="list-style-type: none"> <li>• Laws of inheritance, Monohybrid and dihybrid crosses, Extensions to Mendelism</li> <li>• Molecular basis of Inheritance (DNA replication, transcription, and translation, Genetic code and mutations)</li> <li>• Concept of Gene, Gene mapping, Concept of operon, Genetic disorders</li> </ul>	4
5	<p>Biochemistry and Biophysical techniques</p> <ul style="list-style-type: none"> <li>• Thermodynamics in Biology, Enzyme Kinetics and Regulation</li> <li>• Metabolic Pathways (Glycolysis, Krebs cycle, oxidative phosphorylation: Cell surface receptors, signaling through G-protein coupled receptors, Phosphatidyl inositol pathway, second messengers, cellular transport- Na<sup>+</sup>-K<sup>+</sup> ATPase pump.)</li> <li>• Hormones</li> <li>• Biophysical techniques (Chromatography, Electrophoresis, Spectroscopy, Centrifugation, Microscopy, PCR).</li> </ul>	5
6	<p>Environmental Bio-Engineering</p> <ul style="list-style-type: none"> <li>• Origin of Life and theories of Evolution, Natural selection and adaptation, Phylogenetic Tree,</li> <li>• Patterns and Mechanism of Evolution (Genetic Drift, Mutation, Genetic Variation, Gene Flow,)</li> <li>• Evolution in Human Genome</li> <li>• Ecosystems, Biodiversity and its importance, Pollution and its effects</li> <li>• Bioremediation (Principles and techniques, Applications in environmental engineering)</li> <li>• Engineering technology in Wildlife Sciences and Conservation</li> </ul>	6
7	<p>Biotechnology &amp; Bioinformatics</p> <ul style="list-style-type: none"> <li>• Principles and processes of Biotechnology</li> <li>• Application of Biotechnology in health and agriculture</li> <li>• Recombinant DNA Technology, Tissue Culture</li> <li>• Bioinformatics tools and databases, Sequence alignment and analysis, Applications</li> </ul>	5
8	<p>Immunology &amp; Cancer Biology</p> <ul style="list-style-type: none"> <li>• Innate and adaptive immunity, Cells and organs of the immune system, Humoral and cell-mediated immunity</li> <li>• Immunological Disorders and treatment</li> <li>• Types and stages of cancer, Genetic and environmental factors</li> <li>• Molecular Mechanisms (Oncogenes and tumor suppressor genes, Cell cycle regulation and apoptosis) and Treatment.</li> </ul>	5

<b>Textbook and Reference Books</b>	
1	Biology For Engineers: Dr. Sandhimita Mondal & Dr. Arnab Ganguli : Aryan Publishing House
2	Biology of Engineers, McGraw Hill (ISBN: 978-11-21439-931)
3	Lehninger's Principles of Biochemistry by David L Nelson; A.L. Lehninger and Michael M. Cox, 5th edition, Worth Publishing
4	Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
5	Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons.
6	Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers
7	Principles Of Cancer Biology : Lewis J. Kleinsmith : Pearson Education Limited Edinburgh Gate, Harlow, Essex CM20 2JE ISBN 10:1-292-02788-6 ISBN 13: 978-1-292-02788-3 Pearson Education India.
8	Fundamentals of Biochemistry : J.L Jain : S CHAND & Company Limited
9	Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher.
10	Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
11	Smith & Vanness, Thermodynamics for Chemical Engineers, MGH
12	Shuler and Kargi, Bioprocess engineering: Basic concepts, 2nd edition, Prentice Hall publisher

**Course Outcome:** On completion of the course students will be able to

CSD-406.1	Define / Explain the fundamental concepts / terms of Biology and its necessity / importance.
CSD-406.2	Apply the basic principles to solve simple model problems related to Biology in the real world.
CSD-406.3	Analyze a given Biology problem, design and implement a solution, and compute the output.
CSD-406.4	Identify sub-tasks / sub-systems , Perform Diagnostic assessment of a Biology problem, integrate / interconnect these sub-tasks to design an integrated working solution and Evaluate the solution.
CSD-406.5	Identify unsolved real world Biology problems, Synthesize pragmatic ideas and Create innovative solutions to such problems

**Course Articulation Matrix:**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>CO2</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>CO3</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>CO4</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>CO5</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>Average</b>	3	3	3	3	3	2	2	1	1	2	1	3

	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	3	3	3
<b>CO2</b>	3	3	3
<b>CO3</b>	3	3	3
<b>CO4</b>	3	3	3
<b>CO5</b>	3	3	3

**Dr. B. C. Roy Engineering College, Durgapur**  
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**Syllabus for B. Tech in Computer Science & Design**

**Semester-IV (PRACTICAL)**

<b>Subject/Course Name</b>	Computer Graphics & Animation Lab	<b>Subject/Course Code</b>	CSD-491
<b>Contact Practical/Week</b>	4	<b>Tutorial</b>	Nil
<b>Credit</b>	2	<b>Maximum Marks</b>	100
<b>Examination Scheme</b>			
<b>Internal Exam (CIA)</b>	40	<b>Final Exam (ESE)</b>	60
<b>Objective</b>			
1	Concepts of 2D & 3D object representation		
2	Implementation of various scan & clipping algorithms		
3	Implementation of illumination model for rendering 3D objects		
4	Implementation of a project based on learned concepts.		
5			
6			
<b>Prerequisite</b>			
1	Programming, basic understanding of Geometry, Matrix		
2			
<b>Sl No</b>	<b>Content</b>		
1	Implementation DDA algorithm, Bresenham's line algorithm		
2	Implementation Circle generation algorithm; polygon drawing; fill algorithm		
3	Implementation Scaling, Rotation, Clipping & Viewing		
4	Introduction to Animation in Maya, Animation related interface of Maya and animation preferences		
5	Tools used for Animation in Maya, Key framing, playback and playblast		
6	Introduction to Tangents, Graph editor, Dope sheet.		
7	Applying animation principles to object like bouncing ball		
8	Character Jump Animation,		
9	Character walk cycle animation		
10	Some programming beyond syllabus		

**Course Articulation Matrix:**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>CO2</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>CO3</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>CO4</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>CO5</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>Average</b>	3	3	3	3	3	2	2	1	1	2	1	3

	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>3</b>

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**Syllabus for B. Tech in Computer Science & Design**

**Semester-IV (PRACTICAL)**

<b>Subject/Course Name</b>	Design & Analysis of Algorithms Lab	<b>Subject/Course Code</b>	CSD-492
<b>Contact Practical/Week</b>	4	<b>Tutorial</b>	Nil
<b>Credit</b>	2	<b>Maximum Marks</b>	100
<b>Examination Scheme</b>			
<b>Internal Exam (CIA)</b>	40	<b>Final Exam (ESE)</b>	60
<b>Objective</b>			

1	Know the characteristics of various components.
<b>Prerequisite</b>	
1	Theoretical Knowledge about the subject ESC301
2	
<b>Sl No</b>	<b>Content</b>
1	Implement Binary Search using Divide and Conquer approach Implement Merge Sort using Divide and Conquer approach
2	Implement Quick Sort using Divide and Conquer approach Find Maximum and Minimum element from a array of integer using Divide and Conquer approach
3	Find the minimum number of scalar multiplication needed for chain of matrix
4	Implement all pair of Shortest path for a graph (Floyed- Warshall Algorithm) Implement Traveling Salesman Problem
5	Implement Single Source shortest Path for a graph ( Dijkstra , Bellman Ford Algorithm
6	Implement 15 Puzzle Problem
7	Implement 8 Queen problem
8	Graph Coloring Problem Hamiltonian Problem
9	Knapsack Problem Job sequencing with deadlines
10	Minimum Cost Spanning Tree by Prim's Algorithm Minimum Cost Spanning Tree by Kruskal's Algorithm
11	Implement Breadth First Search (BFS)
12	Implement Depth First Search (DFS)

**Course Articulation Matrix:**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>CO2</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>CO3</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>CO4</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>CO5</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>Average</b>	3	3	3	3	3	2	2	1	1	2	1	3

	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>3</b>

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**Syllabus for B. Tech in Computer Science & Design**

**Semester-IV (PRACTICAL)**

<b>Subject/Course Name</b>	Object Oriented Programming & Design Lab	<b>Subject/Course Code</b>	CSD-493
<b>Contact Practical/Week</b>	4	<b>Tutorial</b>	Nil
<b>Credit</b>	2	<b>Maximum Marks</b>	100
<b>Examination Scheme</b>			
<b>Internal Exam (CIA)</b>	40	<b>Final Exam (ESE)</b>	60
<b>Objective</b>			
1			
2			
<b>Prerequisite</b>			
1			
2			
<b>Sl No</b>	<b>Content</b>		
1	Assignments on class, constructor, overloading, inheritance, overriding		
2	Assignments on wrapper class, arrays		
3	Assignments on developing interfaces- multiple inheritance, extending interfaces		
4	Assignments on creating and accessing packages		
5	Assignments on multithreaded programming		
6	Assignments on applet programming Note: Use Java for programming		
7	Any experiment specially designed by the college (Detailed instructions for Laboratory Manual to be followed for further guidance)		

**Course Articulation Matrix:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>CO2</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>CO3</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>CO4</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>CO5</b>	3	3	3	3	3	2	2	1	1	2	1	3
<b>Average</b>	3	3	3	3	3	2	2	1	1	2	1	3

	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>3</b>