

COURSE STRUCTURE

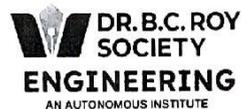
for

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
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Syllabus for B. Tech in Computer Science & Design

Semester: VII					
Sl. No.	Course Type	Course Code	Course Title	Engagement Type	Credit
1	PE	CSD-711	Deep Learning	T	3
		CSD-712	Prototyping Interactive System		
		CSD-713	Multi-agent Intelligent Systems		
2	PE	CSD-721	Blockchain Technology	T	3
		CSD-722	Design Processes and Perspectives		
		CSD-723	Cloud Computing		
3	OE	CSD-731	Big Data Analysis	T	3
		CSD-732	3D Printing & Design		
		CSD-733	Introduction to Philosophical Thoughts		
4	HM	CSD-701	Project Management Entrepreneurship	T	3
5	PJ	CSD-702	Research Methodology	T	2
6	PJ	CSD-781	Project-I (Minor)	S	6
7	GV	CSD-782	Grand Viva 1	S	1
TOTAL CREDIT					21

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Syllabus for B. Tech in Computer Science & Design

Semester-VII			
Subject/Course Name	Deep Learning	Subject/Course Code	CSD-711
Contact Lecture/Week	3	Tutorial	1
Credit	3	Maximum Marks	100
Examination Scheme			
Internal Exam (CIA)	40	Final Exam (ESE)	60
Objective			
1			
Prerequisite			
1			
Unit	Content	Hours/Unit	
1	Introduction: Various paradigms of learning problems, Perspectives and Issues in deep learning framework, review of fundamental learning techniques.	3	
2	Feed forward neural network: Artificial Neural Network, activation function, multilayer neural network, cardinality, operations, and properties of fuzzy relations.	6	
3	Training Neural Network: Risk minimization, loss function, back propagation, regularization, model selection, and optimization	6	
4	Conditional Random Fields: Linear chain, partition function, Markov network, Belief propagation, Training CRFs, Hidden Markov Model, Entropy.	9	
5	Deep Feed Forward network, regularizations, training deep models, dropouts, Convolutional Neural Network, Recurrent Neural Network, Deep Belief Network.	6	
6	Deep Learning research: Object recognition, sparse coding, computer vision, natural language.	6	
Textbook and Reference Books			
1	Goodfellow, I., Bengio, Y., and Courville, A., Deep Learning, MIT Press, 2016.		
2	Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.		
3	Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.		
4	Golub, G.,H., and Van Loan, C.,F., Matrix Computations, JHU Press,2013.		
5	Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.		

6	Dr. Rajiv Chopra, Deep Learning, Khanna Publishing House, New Delhi (AICTE Recommended Textbook – 2018)
Course Outcome: On completion of the course students will be able to	
CSD-711.1	Define / Explain the fundamental concepts / terms of Deep Learning and its necessity / importance.
CSD-711.2	Apply the basic principles to solve simple model problems related to Deep Learning in the real world.
CSD-711.3	Analyze a given Deep Learning problem, design and implement a solution, and compute the output.
CSD-711.4	Identify sub-tasks / sub-systems , Perform Diagnostic assessment of a Deep Learning problem, integrate / interconnect these sub-tasks to design an integrated working solution and Evaluate the solution.
CSD-711.5	Identify unsolved real world Deep Learning 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

	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

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Syllabus for B. Tech in Computer Science & Design

Semester-VII			
Subject/Course Name	Prototyping Interactive System	Subject/Course Code	CSD-712
Contact Lecture/Week	3	Tutorial	1
Credit	3	Maximum Marks	100
Examination Scheme			
Internal Exam (CIA)	40	Final Exam (ESE)	60
Objective			

1	Introduction to Engineering Design is a multidisciplinary course offered with an aim to ignite the students' mind with concepts in design and innovation as well as engineering skills needed to build physical prototypes. Students will learn to work with microcontrollers, smartphones, low- cost materials, and power tools through several in-class activities and lab exercises.
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Prerequisite	
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1	Basic fluency with computers Basic programming knowledge
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Unit	Content	Hours/Unit
1	Course logistics and Overview, System design and functioning of Computing systems, Shell Scripting, Introduction to MIT App Inventor (http://appinventor.mit.edu) for rapid prototyping of apps for Android smartphones, Continuation of MIT App Inventor, Implementation of a simple game using the MIT App Inventor	16
2	Setting up a Raspberry Pi. Accessing ports on Raspberry Pi using python, Shell Scripting, Analog and digital sensors (temperature, GPS, IR, ultrasonic, light intensity, accelerometer, etc), Actuators, Arduino Microcontroller and IDE; Criteria to select a microcontroller: Arduino v/s Raspberry Pi, Processing Language and IDE, Arduino + Processing Integration, Arduino + Android Integration	16
3	Fusion 360: 3D CAD Modeling for 3D Printing, Eagle CAD: Printed CircuitBoard (PCB) Designing, Cloud Computing and Storage: Google Cloud, Github.	16

Textbook and Reference Books	
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1	Fraden, J. 2010. Handbook of modern sensors. Springer. Azuma, R.T. 1997. A survey of augmented reality. Presence. 6, 4 (1997), 355–385.
2	Siewiorek, D. et al. 2008. Application Design for Wearable Computing. Synthesis Lectures on Mobile and Pervasive Computing. 3, 1 (Jan. 2008), 1–66.
3	

4	Wearable Computing Tutorial: http://www.iswc.net/iswc03/iswc2003-intro-tutorial.pdf
5	Making Things Talk, 3e Paperback – 12 Sep 2017 Practical Electronics for Inventors, Fourth Edition Paperback – 16 Apr 2016
6	Make: Paper Inventions (Make: Technology on Your Time) Paperback – 22 Sep 2015
Course Outcome: On completion of the course students will be able to	
CSD-712.1	Define / Explain the fundamental concepts / terms of Prototyping Interactive System and its necessity / importance.
CSD-712.2	Apply the basic principles to solve simple model problems related to Prototyping Interactive System in the real world.
CSD-712.3	Analyze a given Prototyping Interactive System problem, design and implement a solution, and compute the output.
CSD-712.4	Identify sub-tasks / sub-systems , Perform Diagnostic assessment of a Prototyping Interactive System problem, integrate / interconnect these sub-tasks to design an integrated working solution and Evaluate the solution.
CSD-712.5	Identify unsolved real world Prototyping Interactive System 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

	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

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Syllabus for B. Tech in Computer Science & Design

Semester-VII			
Subject/Course Name	Multi-agent Intelligent Systems	Subject/Course Code	CSD-713
Contact Lecture/Week	3	Tutorial	1
Credit	3	Maximum Marks	100
Examination Scheme			
Internal Exam (CIA)	40	Final Exam (ESE)	60
Objective			
1			

Prerequisite		
1		
Unit	Content	Hours/Unit
1	Introduction: what is an agent?: agents and objects; agents and expert systems; agents and distributed systems; typical application areas for agent systems.	8
2	Intelligent Agents: the design of intelligent agents - reasoning agents (eg AgentO), agents as reactive systems (eg subsumption architecture); hybrid agents (eg PRS); layered agents (eg Interrap) a contemporary (Java-based) framework for programming agents (eg the Jack language, the JAM system).	10
3	Multi-Agent Systems: Classifying multi-agent interactions - cooperative versus non-cooperative; zero-sum and other interactions; what is cooperation? how cooperation occurs - the Prisoner's dilemma and Axelrod's experiments; Interactions between self-interested agents: auctions & voting systems: negotiation; Interactions between benevolent agents: cooperative distributed problem solving (CDPS), partial global planning; coherence and coordination; Interaction languages and protocols: speech acts, KQML/KIF, the FIPA framework.	11
4	Advanced topics: One issue selected from the contemporary research literature, perhaps by guest lecturer.	7
Textbook and Reference Books		
1	An Introduction to Multi Agent Systems - Second Edition. Michael Wooldridge (Wiley, 2009)	
2	Programming Multi-agent Systems in Agent Speak Using Jason. Rafael H. Bordini, Jomi Fred Hubner and Michael Wooldridge (Wiley, 2007)	
Course Outcome: On completion of the course students will be able to		

CSD-713.1	Define / Explain the fundamental concepts / terms of Multi-agent Intelligent Systems and its necessity / importance.
CSD-713.2	Apply the basic principles to solve simple model problems related to Multi-agent Intelligent Systems in the real world.
CSD-713.3	Analyze a given Multi-agent Intelligent Systems problem, design and implement a solution, and compute the output.
CSD-713.4	Identify sub-tasks / sub-systems , Perform Diagnostic assessment of a Multi-agent Intelligent Systems problem, integrate / interconnect these sub-tasks to design an integrated working solution and Evaluate the solution.
CSD-713.5	Identify unsolved real world Multi-agent Intelligent Systems 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

	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

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Syllabus for B. Tech in Computer Science & Design

Semester-VII			
Subject/Course Name	Blockchain Technology	Subject/Course Code	CSD-721
Contact Lecture/Week	3	Tutorial	Nil
Credit	3	Maximum Marks	100
Examination Scheme			
Internal Exam (CIA)	40	Final Exam (ESE)	60
Objective			
1			
Prerequisite			
1			
Unit	Content		Hours/Unit
1	Introduction to Cryptography and Cryptocurrency, Bitcoin, Wallet: managing		10

	and protecting crypto assets	
2	Consensus: network models, corruption tolerance, sybil resistance, Nakamoto Consensus: security, attacks and incentives, Randomness beacons, VDFs, and applications to consensus,	10
3	Ethereum: Decentralized Apps, EVM, and the Ethereum blockchain (Ethereum white paper, Ethereum yellow paper, Solidity documentation, Hyperledger Fabric,	6
4	Scaling the Blockchain, Privacy: de-anonymizing the blockchain and mixing, zkSNARKs (Zero-Knowledge Succinct Non-Interactive Argument of Knowledge): a proof construction where one can prove possession of certain information, zkSNARK applications: : confidential transactions and Zcash.	12

Textbook and Reference Books	
1	Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press, 2016
2	Foundation of Consensus, http://elaineshi.com/docs/blockchain-book.pdf

Course Outcome: On completion of the course students will be able to	
CSD-721.1	Define / Explain the fundamental concepts / terms of Blockchain Technology and its necessity / importance.
CSD-721.2	Apply the basic principles to solve simple model problems related to Blockchain Technology in the real world.

CSD-721.3	Analyze a given Blockchain Technology problem, design and implement a solution, and compute the output.
CSD-721.4	Identify sub-tasks / sub-systems , Perform Diagnostic assessment of a Blockchain Technology problem, integrate / interconnect these sub-tasks to design an integrated working solution and Evaluate the solution.
CSD-721.5	Identify unsolved real world Blockchain Technology 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

	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

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Syllabus for B. Tech in Computer Science & Design

Semester-VII			
Subject/Course Name	Design Processes & Perspectives	Subject/Course Code	CSD-722
Contact Lecture/Week	3	Tutorial	Nil
Credit	3	Maximum Marks	100
Examination Scheme			
Internal Exam (CIA)	40	Final Exam (ESE)	60
Objective			
1	This course introduces students to the theoretical and practical aspects of design evolving processes. The course presents the varied palette of design from design of physical objects, to design of human computer interactions, to design of services, to design of micro systems and connected/complex systems. It initiates the process of learning fundamental skills such as observation & representation, investigation, canalization, synthesis, conceptualization, reflections, projection, visualization & representation. Topics such as Design Processes, Design Perspectives, Design Context & Concerns, Problem Solving Methods, Idea Generation, User- Focused Thinking and Basic Communication are covered during the course.		
Prerequisite			
1			
Unit	Content	Hours/Unit	
1	INTRODUCTION TO PROBLEM SOLVING PROCESS Factors Influencing Design, Brief/Opportunity/Need/'Leap of Faith', Research/ Investigation, Analysis/ Synthesis/ Findings/ Insights, Problem Statement, Conceptualisation /Ideation/ Visualization, Options & Alternatives, Final Solution, Implementation/execution, Evaluation/ Validation/Testing, Improve/Modify/ Amend/ Revise	8	
2	ANALYSIS OF A SIMPLE PROBLEM IN A GIVEN CONTEXT Mind Maps, affinity mappings, Empathy Mapping, User Story Mapping,	10	

	Semiotic Analysis (Syntax-Semantic-Pragmatic), observations, Insights and Opportunities, Soft Prototyping the idea/ concept, Documentation, report making and presentations, understanding and defining 'Context' – Exposure to different perspectives, concerns and issues in the context of design.	
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3	<p>DESIGN PERSPECTIVES: CONTEXT & CONCERNS</p> <p>Understanding and defining 'Concerns' – Fundamental yet subjective questions like what makes a good designer. Areas of concerns : social concerns, economic concerns, political concerns, environmental concerns etc Tangible and Intangible relevance of broadening one's perspectives in Arts Aesthetics, Science and Technology in Design, The Challenges in Design - Designing for the Real World, Emerging Areas of Design. Relevance of Design in the Context of India. Importance of Sustainable Design Practices - Preserving traditional practices & designing for the underserved communities.</p>	10
4	<p>THE NOTION OF THE DESIGNER 'SELF' AND THE 'OTHER/USER' The Hierarchy of the 'Other'</p> <p>Framing the Problem with Reference to Context; Framing Research Questions, Framing the Design Process: Identifying Methodologies and Strategies related to the different stages of Problem Solving Process, CREATIVE DESIGN THINKING METHODS Introduction to various Techniques/Tools for Ideation: Brain Storming, Browsing, Word Association, Attribute Listing, Mind Mapping, Affinity Mapping, Card Sorting, Visualization, Conceptualisation, Ideation of multiple solutions, Validation, Testing.</p>	8

Textbook and Reference Books

1	
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Course Outcome: On completion of the course students will be able to

CSD-722.1	Define / Explain the fundamental concepts / terms of Design Processes & Perspectives and its necessity / importance.
CSD-722.2	Apply the basic principles to solve simple model problems related to Design Processes & Perspectives in the real world.
CSD-722.3	Analyze a given Design Processes & Perspectives problem, design and implement a solution, and compute the output.
CSD-722.4	Identify sub-tasks / sub-systems , Perform Diagnostic assessment of a Design Processes & Perspectives problem, integrate / interconnect these sub-tasks to design an integrated working solution and Evaluate the solution.
CSD-722.5	Identify unsolved real world Design Processes & Perspectives 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

	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

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Syllabus for B. Tech in Computer Science & Design

Semester-VII			
Subject/Course Name	Cloud Computing	Subject/Course Code	CSD-723
Contact Lecture/Week	3	Tutorial	Nil
Credit	3	Maximum Marks	100
Examination Scheme			
Internal Exam (CIA)	40	Final Exam (ESE)	60
Objective			
1			
Prerequisite			
1			

Unit	Content	Hours/Unit
1	<p><u>Definition of Cloud Computing and its Basics (Lectures)</u>. Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public , Private, Hybrid and Community Clouds), Service Platform as a Service, Software as a Service with examples of services/ service providers, models – Infrastructure as a Service, Cloud Reference model, Characteristics of Cloud Computing – a shift in paradigm Benefits and advantages of Cloud Computing, A brief introduction on Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud by Clients, IaaS – Basic concept, Workload, partitioning of virtual private server instances, Pods, aggregations, silos PaaS – Basic concept, tools and development environment with examples SaaS - Basic concept and characteristics, Open SaaS and SOA, examples of SaaS platform Identity as a Service (IDaaS) Compliance as a Service (CaaS)</p>	9

2	<p>Use of Platforms in Cloud Computing Concepts of Abstraction and Virtualization Virtualization technologies : Types of virtualization (access, application, CPU, storage), Mobility patterns (P2V, V2V, V2P, P2P, D2C, C2C, C2D, D2D) Load</p> <p>Balancing and Virtualization: Basic Concepts, Network resources for load balancing, Advanced load balancing (including Application Delivery Controller and Application Delivery Network), Mention of The Google Cloud as an example of use of load balancing Hypervisors: Virtual machine technology and types, VMware vSphere Machine Imaging (including mention of Open Virtualization Format – OVF)</p> <p>Porting of applications in the Cloud: The simple Cloud API and AppZero Virtual Application appliance, Concepts of Platform as a Service, Definition of services, Distinction between SaaS and PaaS (knowledge of Salesforce.com and Force.com), Application development</p> <p>Use of PaaS Application frameworks,</p> <p>Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service., Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service,</p> <p>Windows Azure platform: Microsoft’s approach, architecture, and main elements, overview of Windows Azure AppFabric, Content Delivery Network, SQL Azure, and Windows Live services</p>	12
3	<p><u>Cloud Infrastructure:</u></p> <p>Cloud Management:</p> <p>An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle).</p> <p>Concepts of Cloud Security:</p> <p>Cloud security concerns, Security boundary, Security service boundary</p> <p>Overview of security mapping Security of data: Brokered cloud storage access, Storage location and tenancy, encryption, and auditing and compliance Identity management (awareness of Identity protocol standards)</p>	7
4	<p>Concepts of Services and Applications :</p> <p>Service Oriented Architecture: Basic concepts of message- based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Service catalogs, Applications in the Cloud: Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs</p> <p>Cloud-based Storage: Cloud storage definition – Manned and Unmanned</p> <p>Webmail Services: Cloud mail services including Google</p> <p>Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services</p>	8

Textbook and Reference Books	
1	Cloud Computing Bible by Barrie Sosinsky, Wiley India Pvt. Ltd, 2013
2	Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw Hill Education (India) Private Limited, 2013
3	Cloud computing: A practical approach, Anthony T. Velte, Tata Mcgraw-Hill
4	Cloud Computing, Miller, Pearson
5	Building applications in cloud: Concept, Patterns and Projects, Moyer, Pearson
6	Cloud Computing – Second Edition by Dr. Kumar Saurabh, Wiley India

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

CSD-723.1	Define / Explain the fundamental concepts / terms of Cloud Computing and its necessity / importance.
CSD-723.2	Apply the basic principles to solve simple model problems related to Cloud Computing in the real world.
CSD-723.3	Analyze a given Cloud Computing problem, design and implement a solution, and compute the output.
CSD-723.4	Identify sub-tasks / sub-systems , Perform Diagnostic assessment of a Cloud Computing problem, integrate / interconnect these sub-tasks to design an integrated working solution and Evaluate the solution.
CSD-723.5	Identify unsolved real world Cloud Computing 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

	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

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Syllabus for B. Tech in Computer Science & Design

Semester-VII			
Subject/Course Name	Big Data Analytics	Subject/Course Code	CSD-731
Contact Lecture/Week	3	Tutorial	Nil
Credit	3	Maximum Marks	100
Examination Scheme			
Internal Exam (CIA)	40	Final Exam (ESE)	60
Objective			
1	Understand big data for business intelligence.		
2	Learn business case studies for big data analytics.		
3	Understand noSQL big data management.		
4	Perform map-reduce analytics using Hadoop and related tools		
Prerequisite			
1			
Unit	Content	Hours/Unit	
1	What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.	8	
2	Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peer peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations.	8	
3	Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures	9	

4	MapReduce workflows, unit tests with MR Unit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats	10
5	Hbase, data model and implementations, Hbase clients, Hbase examples, praxis.Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration.	7
6	Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries.	6

Textbook and Reference Books

1	Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging
2	V.K. Jain, Big Data and Hadoop, Khanna Publishing House, New Delhi (2017).
3	V.K. Jain, Data Analysis, Khanna Publishing House, New Delhi (2019).
4	Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
5	P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
6	Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
7	Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
8	E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
9	Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
10	Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
11	Alan Gates, "Programming Pig", O'Reilley, 2011.

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

CSD-731.1	Define / Explain the fundamental concepts / terms of Big Data Analytics and its necessity / importance.
CSD-731.2	Apply the basic principles to solve simple model problems related to Big Data Analytics in the real world.
CSD-731.3	Analyze a given Big Data Analytics problem, design and implement a solution, and compute the output.
CSD-731.4	Identify sub-tasks / sub-systems , Perform Diagnostic assessment of a Big Data Analytics problem, integrate / interconnect these sub-tasks to design an integrated working solution and Evaluate the solution.
CSD-731.5	Identify unsolved real world Big Data Analytics 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

	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Dr. B. C. Roy Engineering College, Durgapur
(An Autonomous Institution)

Syllabus for B. Tech in Computer Science & Design

Semester-VII			
Subject/Course Name	3D Printing and Design	Subject/Course Code	CSD-732
Contact Lecture/Week	3	Tutorial	Nil
Credit	3	Maximum Marks	100
Examination Scheme			
Mid Semester exam: 15	Assignment and Quiz: 10 marks	Attendance: 5 marks	End Semester Exam :70 Marks
Objective			
1			
Prerequisite			
1			
Unit	Content	Hours/Unit	
1	3D Printing (Additive Manufacturing): Introduction, Process, Classification, Advantages, Additive V/s Conventional Manufacturing processes, Applications. CAD for Additive Manufacturing: CAD Data formats, Data translation, Data loss, STL format.	5	
2	Additive Manufacturing Techniques: Stereo-Lithography, LOM, FDM, SLS, SLM, Binder Jet technology. Process, Process parameter, Process Selection for various applications. Additive Manufacturing Application Domains: Aerospace, Electronics, Health Care, Defence, Automotive, Construction, Food Processing, Machine Tools	10	
3	Materials: Polymers, Metals, Non-Metals, Ceramics Various forms of raw material- Liquid, Solid, Wire, Powder; Powder Preparation and their desired properties, Polymers and their properties. Support Materials	10	
4	Additive Manufacturing Equipment: Process Equipment- Design and process parameters Governing Bonding Mechanism Common faults and troubleshooting, Process Design Post Processing: Requirement and Techniques	11	
Textbook and Reference Books			
1	L. Gibson, D.W. Rosen and B. Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Springer, 2010.		
2	A. Gebhardt, Understanding Additive Manufacturing: Rapid Prototyping, Rapid Tooling,		

	Rapid Manufacturing, Hanser Publisher, 2011.
3	C.K. Chua and K.F. Leong, 3D Printing and Rapid Prototyping- Principles and Applications, World Scientific, 2017.
4	J.D. Majumdar and I. Manna, Laser-Assisted Fabrication of Materials, Springer Series in Material Science, 2013.
5	L. Lu, J. Fuh and Y.S. Wong, Laser-Induced Materials and Processes for Rapid Prototyping, Kulwer Academic Press, 2001.
6	Z. Fan and F. Liou, Numerical Modelling of the Additive Manufacturing (AM)Processes of Titanium Alloy, InTech, 2012.

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

CSD-732.1	Define / Explain the fundamental concepts / terms of 3D Printing and Design and its necessity / importance.
CSD-732.2	Apply the basic principles to solve simple model problems related to 3D Printing and Design in the real world.
CSD-732.3	Analyze a given 3D Printing and Design problem, design and implement a solution, and compute the output.
CSD-732.4	Identify sub-tasks / sub-systems , Perform Diagnostic assessment of a 3D Printing and Design problem, integrate / interconnect these sub-tasks to design an integrated working solution and Evaluate the solution.
CSD-732.5	Identify unsolved real world 3D Printing 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
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

	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Dr. B. C. Roy Engineering College, Durgapur
(An Autonomous Institution)

Syllabus for B. Tech in Computer Science & Design

Semester-VII			
Subject/Course Name	Introduction to Philosophical Thoughts	Subject/Course Code	CSD-733
Contact Lecture/Week	3	Tutorial	Nil
Credit	3	Maximum Marks	100
Examination Scheme			
Internal Exam (CIA)	40	Final Exam (ESE)	60
Objective			
1			
Prerequisite			
1			
Unit	Content	Hours/Unit	
1	Nature of Indian Philosophy: Plurality as well as common concerns. 2. Basic concepts of the Vedic and Upanisadic views: Atman, Jagrata, Svapna, Susupti, Turiya, Brahman, Karma, Rta, Rna,	15	
2	Carvaka school: its epistemology, metaphysics and ethics. Mukti	6	
3	Jainism: Concepts of sat, dravya, guna, paryaya, jiva, ajiva, anekantavada, syadvada, and nayavada ; pramanas, ahimsa, bondage and liberation.	5	
4	5. Buddhism: theory of pramanas, theory of dependent origination, the four noble truths; doctrine of momentaryness; theory of no soul. The interpretation of these theories in schools of Buddhism: Vaibhasika, Sautrantrika, Yogacara, Madhyamika.	5	
5	6. Nyaya: theory of Pramanas; the individual self and its liberation; the idea of God and proofs for His existence.	5	
Textbook and Reference Books			
1	M. Hiriyanna : Outlines of Indian Philosophy.		
2	C.D.Sharma : A Critical Survey of Indian Philosophy.		
3	S.N.Das Gupta : A History of Indian Philosophy Vol – I to V.		
4	S.Radhakrishnan : Indian Philosophy Vol – I & II.		
5	T.R.V.Murti : Central Philosophy of Buddhism.		
6	J.N.Mahanty : Reason and Tradition of Indian Thought.		

Course Outcome: On completion of the course students will be able to	
CSD-733.1	Define / Explain the fundamental concepts / terms of Introduction to Philosophical Thoughts and its necessity / importance.
CSD-733.2	Apply the basic principles to solve simple model problems related to Introduction to Philosophical Thoughts in the real world.
CSD-733.3	Analyze a given Introduction to Philosophical Thoughts problem, design and implement a solution, and compute the output.
CSD-733.4	Identify sub-tasks / sub-systems , Perform Diagnostic assessment of an Introduction to Philosophical Thoughts problem, integrate / interconnect these sub-tasks to design an integrated working solution and Evaluate the solution.
CSD-733.5	Identify unsolved real world Introduction to Philosophical Thoughts 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

	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Dr. B. C. Roy Engineering College, Durgapur
(An Autonomous Institution)

Syllabus for B. Tech in Computer Science & Design

Semester-VII			
Subject/Course Name	Project Management and Entrepreneurship	Subject/Course Code	CSD-701
Contact Lecture/Week	3	Tutorial	1
Credit	3	Maximum Marks	100
Examination Scheme			

Mid Semester exam: 15	Assignment and Quiz: 10 marks	Attendance: 5 marks	End Semester Exam: 70 Marks
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Objective	
1	

Prerequisite	
1	

Unit	Content	Hours/Unit
1	Introduction: Meaning and Concept of Entrepreneurship, Innovation and entrepreneurship, Contributions of entrepreneurs to the society, risk-opportunities perspective and mitigation of risks	2
2	Entrepreneurship – An Innovation: Challenges of Innovation, Steps of Innovation Management, Idea Management System, Divergent v/s Convergent Thinking, Qualities of a prospective Entrepreneur	2
3	Idea Incubation: Factors determining competitive advantage, Market segment, blue ocean strategy, Industry and Competitor Analysis (market structure, market size, growth potential), Demand-supply analysis	4
4	Entrepreneurial Motivation: Design Thinking - Driven Innovation, TRIZ (Theory of Inventive Problem Solving), Achievement motivation theory of entrepreneurship – Theory of McClelland, Harvesting Strategies	2
5	Information: Government incentives for entrepreneurship, Incubation, acceleration. Funding new ventures – bootstrapping, crowd sourcing, angel investors, Government of India's efforts at promoting entrepreneurship and innovation – SISI, KVIC, DGFT, SIDBI, Defense and Railways	4
6	Closing the Window: Sustaining Competitiveness, Maintaining Competitive Advantage, the Changing Role of the Entrepreneur.	2
7	Applications and Project Reports Preparation	4

8	PROJECT MANAGEMENT: Definitions of Project and Project Management, Issues and Problems in Project Management, Project Life Cycle - Initiation / Conceptualization Phase, Planning Phase, Implementation / Execution Phase, Closure / Termination Phase	4
9	Project Feasibility Studies – Pre-Feasibility and Feasibility Studies, Preparation of Detailed Project Report, Technical Appraisal, Economic /Commercial /Financial Appraisal including Capital Budgeting Process, Social Cost Benefit Analysis	2
10	Project Planning – Importance of Project Planning, Steps of Project Planning, Project Scope, Work Breakdown Structure (WBS) and Organization Breakdown Structure (OBS), Phased Project Planning	2
11	Project Scheduling and Costing – Gantt chart, CPM and PERT Analysis, Identification of the Critical Path and its Significance, Calculation of Floats and Slacks, Crashing, Time Cost Trade-off Analysis, Project Cost Reduction Methods.	6
12	Project Monitoring and Control – Role of Project Manager, MIS in Project Monitoring, Project Audit	2
13	Case Studies with Hands-on Training on MS-Project	4

Textbook and Reference Books

1	Innovation and Entrepreneurship by Drucker, P.F.; Harper and Row 2. Business, Entrepreneurship and Management: Rao, V.S.P.;Vikas 3. Entrepreneurship: Roy Rajeev; OUP.
2	Text Book of Project Management: Gopalkrishnan, P. and Ramamoorthy, V.E.; McMillan
3	Project Management for Engineering, Business and Technology: Nicholas, J.M., and Steyn, H.; PHI

4	Project Management: The Managerial Process: Gray, C.F., Larson, E.W. and Desai, G.V.; MGH
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Course Outcome: On completion of the course students will be able to

CSD-701.1	Define / Explain the fundamental concepts / terms of Project Management and Entrepreneurship and its necessity / importance.
CSD-701.2	Apply the basic principles to solve simple model problems related to Project Management and Entrepreneurship in the real world.
CSD-701.3	Analyze a given Project Management and Entrepreneurship problem, design and implement a solution, and compute the output.
CSD-701.4	Identify sub-tasks / sub-systems , Perform Diagnostic assessment of an Project Management and Entrepreneurship problem, integrate / interconnect these sub-tasks to design an integrated working solution and Evaluate the solution.
CSD-701.5	Identify unsolved real world Project Management and Entrepreneurship 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

	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Dr. B. C. Roy Engineering College, Durgapur
(An Autonomous Institution)

Syllabus for B. Tech in Computer Science & Design

Semester-VII			
Subject/Course Name	Research Methodology	Subject/Course Code	CSD-702
Contact Lecture/Week	2	Tutorial	Nil
Credit	2	Maximum Marks	100
Examination Scheme			
Internal Exam (CIA)	Nil	Final Exam (ESE)	100
Objective			
1			
Prerequisite			
1			
Unit	Content		Hours/Unit
1	RESEARCH FORMULATION AND DESIGN The role of Design Research Why is it so Important? Motivation and objectives – Research methods vs. Methodology. Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, concept of applied and basic research process, criteria of good research. Defining and formulating the research problem, selecting the problem, necessity of defining the problem, importance of literature review in defining a problem, literature review-primary and secondary sources, reviews, monograph, patents, research databases, web as a source, searching the web, critical literature review, identifying gap areas from literature and research database, development of Working hypothesis.		6
2	DATA COLLECTION AND ANALYSIS Accepts of method validation, observation and collection of data, methods of data collection, sampling methods, data processing and analysis strategies and tools, data analysis with statically package (Sigma STAT, SPSS for student t-test, ANOVA, etc.), hypothesis testing.		7
3	RESEARCH ETHICS, IPR AND SCHOLARLY PUBLISHING Ethics-ethical issues, ethical committees (human & animal); IPR- intellectual property rights and patent law, commercialization, copy right, royalty, trade related aspects of intellectual property rights (TRIPS); scholarly publishing IMRAD concept and design of research paper, citation and acknowledgement, plagiarism, reproducibility and accountability		5
4	INTERPRETATION AND REPORT WRITING Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Project Report, Layout of the Project/Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Project/Research Report, Precautions for Writing Research Reports, Conclusions.		6

Textbook and Reference Books	
1	Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
2	Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.
3	Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, EssEss Publications. 2 volumes.

4	Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
5	Wadehra, B.L. 2000. Law relating to patents, trademarks, copyright designs and geographical indications. Universal Law Publishing.
6	Anthony, M., Graziano, A.M. and Raulin, M.L., 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
7	Carlos, C.M., 2000. Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options. Zed Books, New York.
8	Coley, S.M. and Scheinberg, C. A., 1990, "Proposal Writing", Sage Publications.

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

CSD-702.1	Define / Explain the fundamental concepts / terms of Research Methodology and its necessity / importance.
CSD-702.2	Apply the basic principles to solve simple model problems related to Research Methodology in the real world.
CSD-702.3	Analyze a given Research Methodology problem, design and implement a solution, and compute the output.
CSD-702.4	Identify sub-tasks / sub-systems , Perform Diagnostic assessment of a Research Methodology problem, integrate / interconnect these sub-tasks to design an integrated working solution and Evaluate the solution.
CSD-702.5	Identify unsolved real world Research Methodology 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

	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

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

Semester-VII			
Subject/Course Name	Project I (Minor)	Subject/Course Code	CSD-781
Contact Lecture/Week		Tutorial	Nil
Credit	6	Maximum Marks	100
Examination Scheme			
Internal Exam (CIA)	Nil	Final Exam (ESE)	100
Objective			
1			
Prerequisite			
1			

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

	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

Dr. B. C. Roy Engineering College, Durgapur
(An Autonomous Institution)

Syllabus for B. Tech in Computer Science & Design

Semester-VII			
Subject/Course Name	Grand Viva I	Subject/Course Code	CSD-782
Contact Lecture/Week		Tutorial	Nil
Credit	1	Maximum Marks	100
Examination Scheme			
Internal Exam (CIA)	Nil	Final Exam (ESE)	100
Objective			
1			
Prerequisite			
1			

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

	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3