



Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore
Shri Vaishnav Institute of Information Technology
Choice Based Credit System (CBCS)
B.Tech. (CSE - Big Data and Cloud Engineering – Impetus
Technologies)
Semester-VI (2020-2024)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			ENDESEM University Exam	Two Term Exam	Teachers Assessment*	ENDESEM University Exam	Teachers Assessment*				
BTCS501	DCC	Theory of Computation	60	20	20	-	-	3	1	-	4

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;
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Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES

The student will have ability to:

1. To introduce concepts in automata theory and theory of computation.
2. To identify different formal language classes and their relationships.
3. To design grammars and recognizers for different formal languages.

COURSE OUTCOMES

Upon completion of the subject, students will be able to:

1. Ability to relate practical problems to languages, automata, and computability.
2. Ability to demonstrate an increased level of mathematical sophistication.
3. Ability to apply mathematical and formal techniques for solving problems.

SYLLABUS

UNIT-I

Introduction: Alphabets, Strings and Languages; Automata and Grammars, Deterministic finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, Transition table, Language of DFA, Nondeterministic finite Automata (NFA), NFA with epsilon transition, Language of NFA, Equivalence of NFA and DFA, Minimization of Finite Automata, Distinguishing one string from other, Myhill-Nerode Theorem.

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BTCS501	DCC	Theory of Computation	60	20	20	-	-	3	1	-	4

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UNIT-II

Regular Expression (RE): Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen’s Theorem, Regular expression to FA, DFA to Regular expression, Arden's Theorem, Non Regular Languages, and Pumping Lemma for regular Languages. Application of Pumping Lemma, Closure properties of Regular Languages, Decision properties of Regular Languages FA with output and Mealy machine, Equivalence of Moore and Mealy of Moore Application and Limitations of FA

UNIT-III

Context Free Grammar (CFG) and Context Free Languages (CFL): Definition, Examples, Derivation, Derivation trees, Ambiguity in Grammar, Inherent ambiguity, Ambiguous to Unambiguous CFG, Useless symbols, Simplification of CFGs, Normal forms for CFGs: CNF and GNF, Closure properties of CFLs, Decision Properties of CFLs: Emptiness, Finiteness and Membership, Pumping lemma for CFLs.

UNIT-IV

Push Down Automata (PDA): Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA and PDA to CFG.

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UNIT–V Turing machines (TM): Basic model, definition and representation, Instantaneous Description, Language acceptance by TM, Variants of Turing Machine, TM as Computer of Integer functions, Universal TM, Church’s Thesis, Recursive and recursively enumerable languages, Halting problem, Introduction to undecidability, undecidable problems about TM, NP hard and NP complete problem, Post correspondence problem (PCP), Modified PCP, Introduction to recursive function theory.

TEXT BOOKS:

1. Hopcroft and Ullman, “Introduction to Automata Theory, Languages and Computation”, Pearson Education, 3rd edition, 2014
2. Peter Linz, "An Introduction to Formal Language and Automata", NarosaPub.House, 2011.
3. K.L.P Mishra & N.Chandrasekaran, “Theory of Computer Science”, PHI Learning, 3rd edition, 2006

REFERENCES:

1. Martin J. C., “Introduction to Languages and Theory of Computations”, TMH, 4th edition, 2010.
2. Papadimitriou, C. and Lewis, C. L., “Elements of the Theory of Computation”, PHI, 1997.
3. Michael Sipser, “Introduction to Theory of Computation”, Cengage Learning, 3rd edition, 2013

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BTCS608	DCC	Data Science	60	20	20	30	20	3	0	2	4

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COURSE OBJECTIVES

1. The objective of this course is to impart necessary knowledge of the mathematical foundations needed for data science and develop programming skills required to build data science applications.

COURSE OUTCOMES

Upon completion of the subject, students will be able to:

1. Demonstrate understanding of the mathematical foundations needed for data science.
2. Collect, explore, clean, munge and manipulate data.
3. Implement models such as k-nearest Neighbors, Naive Bayes, linear and logistic regression, decision trees, neural networks and clustering.
4. Build data science applications using Python based toolkits.

SYLLABUS

UNIT-I

Introduction to Data Science: Concept of Data Science, Traits of Big data, Web Scraping, Analysis vs Reporting.

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UNIT-II

Introduction to Programming Tools for Data Science: Toolkits using Python: Matplotlib, NumPy, Scikit-learn, NLTK, Visualizing Data: Bar Charts, Line Charts, Scatterplots, Working with data: Reading Files, Scraping the Web, Using APIs (Example: Using the Twitter APIs), Cleaning and Munging, Manipulating Data, Rescaling, Dimensionality Reduction.

UNIT-III

Mathematical Foundations: Linear Algebra: Vectors, Matrices, Statistics: Describing a Single Set of data correlation, Simpsons Paradox, Correlation and Causation, Probability: Dependence and Independence conditional Probability Bayes's Theorem, Random Variables Continuous Distributions, The Normal Distribution, The Central Limit Theorem, Hypothesis and Inference: Statistical Hypothesis Testing, Confidence Intervals, Phacking, Bayesian Inference.

UNIT-IV

Machine Learning: Overview of Machine learning concepts – Over fitting and train/test splits, Types of Machine learning – Supervised, Unsupervised, Reinforced learning, Introduction to Bayes Theorem, Linear Regression- model assumptions, regularization (lasso, ridge, elastic net), Classification and Regression algorithms- Naïve Bayes, K-Nearest Neighbors, logistic regression, support vector machines (SVM), decision trees, and random forest, Classification Errors, Analysis of Time Series- Linear Systems Analysis, Nonlinear Dynamics, Rule Induction, Neural Networks- Learning And Generalization, Overview of Deep Learning.

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UNIT-V

Case Studies of Data Science Application: Weather forecasting, Stock market prediction, Object recognition, Real Time Sentiment Analysis.

TEXT BOOKS:

1. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media.
2. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition, O'Reilly Media.
3. Jain V.K., "Data Sciences", Khanna Publishing House, Delhi.
4. Jain V.K., "Big Data and Hadoop", Khanna Publishing House, Delhi.
5. Jeeva Jose, "Machine Learning", Khanna Publishing House, Delhi.
6. Chopra Rajiv, "Machine Learning", Khanna Publishing House, Delhi.
7. Ian Goodfellow, Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press <http://www.deeplearningbook.org>
8. Jiawei Han and Jian Pei, "Data Mining Concepts and Techniques", Third Edition, Morgan Kaufmann Publishers

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List of Practical's:

1. Write a programme in Python to predict the class of the flower based on available attributes.
2. Write a programme in Python to predict if a loan will get approved or not.
3. Write a programme in Python to predict the traffic on a new mode of transport.
4. Write a programme in Python to predict the class of user.
5. Write a programme in Python to indentify the tweets which are hate tweets and which are not.
6. Write a programme in Python to predict the age of the actors.
7. Mini project to predict the time taken to solve a problem given the current status of the user.

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BTCS602	DCC	Internet Of Things	60	20	20	30	20	3	0	2	4

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

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COURSE OBJECTIVES:

1. The objective of this course is to impart necessary and practical knowledge of components of Internet of Things and develop skills required to build real-life IoT based projects.

COURSE OUTCOMES:

Upon completion of the subject, students will be able to:

1. Understand internet of Things and its hardware and software components
2. Interface I/O devices, sensors & communication modules
3. Remotely monitor data and control devices
4. Develop real life IoT based projects

SYLLABUS

UNIT-I

Introduction to IoT: Architectural Overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gateways, Data management, Business processes in IoT, Everything as a Service (XaaS), Role of Cloud in IoT, Security aspects in IoT

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BTCS602	DCC	Internet Of Things	60	20	20	30	20	3	0	2	4

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UNIT-II

Elements of IoT: Hardware Components- Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces.

Software Components- Programming API's (using Python/Node.js/Arduino) for Communication Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP.

UNIT-III

IoT Application Development: Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration.

UNIT-IV

Device data storage: Unstructured data storage on cloud/local server, Authentication, authorization of devices.

UNIT-V

IoT Case Studies: IoT case studies and mini projects based on Industrial automation, Transportation, Agriculture, Healthcare, Home Automation

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TEXT BOOKS:

1. Vijay Madiseti, ArshdeepBahga, Internet of Things, “A Hands on Approach”, University Press.
2. Dr. SRN Reddy, RachitThukral and Manasi Mishra, “Introduction to Internet of Things: A practical Approach”, ETI Labs.
3. Pethuru Raj and Anupama C. Raman, “The Internet of Things: Enabling Technologies, Platforms, and Use Cases”, CRC Press
4. Jeeva Jose, “Internet of Things”, Khanna Publishing House, Delhi.
5. Adrian McEwen, “Designing the Internet of Things”, Wiley.
6. Raj Kamal, “Internet of Things: Architecture and Design”, McGraw Hill.
7. Cuno Pfister, “Getting Started with the Internet of Things”, O Reilly Media.

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LIST OF PRACTICALS:

1. Familiarization with Arduino/Raspberry Pi and perform necessary software installation.
2. To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.
3. To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.
4. To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
5. To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.
6. To interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.
7. To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.
8. To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetooth.
9. Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to thingspeak cloud.
10. Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from thingspeak cloud.
11. To install MySQL database on Raspberry Pi and perform basic SQL queries.
12. Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.

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13. Write a program on Arduino/Raspberry Pi to subscribe to MQTT broker for temperature data and print it.
14. Write a program to create TCP server on Arduino/Raspberry Pi and respond with humidity data to TCP client when requested.
15. Write a program to create UDP server on Arduino/Raspberry Pi and respond with humidity data to UDP client when requested.

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BTCS618	DSE	Block Chain	60	20	20	30	20	2	1	2	4

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COURSE OBJECTIVES

The student will have ability to:

1. Provide conceptual understanding of how block chain technology can be used to innovate and improve business processes.
2. Covers the technological underpinning of block Chain operations in both theoretical and practical implementation of solutions using block Chain technology.

COURSE OUTCOMES

Upon completion of the subject, students will be able to:

1. Understand block chain technology.
2. Develop block chain based solutions and write smart contract using Hyperledger Fabric and Ethereum frameworks.
3. Build and deploy block chain application for on premise and cloud based architecture.
4. Integrate ideas from various domains and implement them using Integrate ideas from various domains and implement them using

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SYLLABUS

UNIT-I

Introduction: Overview of Block chain, Public Ledgers, Bitcoin, Smart Contracts, Block in a Block chain, Transactions, Distributed Consensus, Public vs Private Block chain, Understanding Crypto currency to Block chain, Permissioned Model of Block chain, Overview of Security aspects of Block chain.

Basic Crypto Primitives: Cryptographic Hash Function, Properties of a hash function, Hash pointer and Merkle tree, Digital Signature, Public Key Cryptography, A basic cryptocurrency.

UNIT -II

Understanding Block chain with Crypto currency: Bitcoin and Block chain: Creation of coins, Payments and double spending, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay.

Working with Consensus in Bitcoin: Distributed consensus in open environments, Consensus in a Bitcoin network, Proof of Work (PoW) – basic introduction, Hashcash PoW, Bitcoin PoW, Attacks on PoW and the monopoly problem, Proof of Stake, Proof of Burn and Proof of Elapsed Time, The life of a Bitcoin Miner, Mining Difficulty, Mining Pool.

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			THEORY			PRACTICAL		L	T	P	CREDITS
			ENDSEM University Exam	Two Term Exam	Teachers Assessment*	ENDSEM University Exam	Teachers Assessment*				
BTCS618	DSE	Block Chain	60	20	20	30	20	2	1	2	4

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

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UNIT-III

Understanding Block chain for Enterprises: Permissioned Block chain: Permissioned model and use cases, Design issues for Permissioned block chains, Execute contracts, State machine replication, Overview of Consensus models for permissioned block chain- Distributed consensus in closed environment, Paxos, RAFT Consensus, Byzantine general problem, Byzantine fault tolerant system, Lamport-Shostak-Pease BFT Algorithm, BFT over Asynchronous systems.

UNIT-IV

Enterprise application of Block chain: Cross border payments, Know Your Customer (KYC), Food Security, Mortgage over Block chain, Block chain enabled Trade, We Trade – Trade Finance Network, Supply Chain Financing, Identity on Block chain

UNIT-V

Block chain application development: Hyperledger Fabric- Architecture, Identities and Policies, Membership and Access Control, Channels, Transaction Validation, Writing smart contract using Hyperledger Fabric, Writing smart contract using Ethereum, Overview of Ripple and Corda.

TEXT BOOKS:

1. Melanie Swan, “Block Chain: Blueprint for a New Economy”, O’Reilly, 2015
2. Josh Thompsons, “Block Chain: The Block Chain for Beginners- Guide to Block chain Technology and Leveraging Block Chain Programming”.

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3. Daniel Drescher, “Block Chain Basics”, Apress; 1st edition, 2017.
4. Anshul Kaushik, “Block Chain and Crypto Currencies”, Khanna Publishing House, Delhi.
5. Imran Bashir, “Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained”, Packt Publishing
6. Ritesh Modi, “Solidity Programming Essentials: A Beginner’s Guide to Build Smart Contracts for Ethereum and Block Chain”, Packt Publishing.
7. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O’Dowd,
8. Venkatraman. Ramakrishna, “Hands-On Block Chain with Hyperledger: Building Decentralized Applications with Hyperledger Fabric and Composer”, Import, 2018

List of Practical’s:

1. Install and understand Docker container, Node.js, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on Cloud to run.
<https://github.com/hyperledger/>

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<https://docs.docker.com/get-started/https://console.ng.bluemix.net/docs/services/block-chain/index.html>
https://console.bluemix.net/docs/containers/container_index.html#container_index

2. Create and deploy a block chain network using Hyperledger Fabric SDK for Java Set up and initialize the channel, install and instantiate chaincode, and perform invoke and query on your block chain network

<https://developer.ibm.com/patterns/create-and-deploy-block-chain-network-using-fabric-sdk-java/>

Interact with a block chain network. Execute transactions and requests against a block chain network by creating an app to test the network and its rules.

<https://developer.ibm.com/patterns/interacting-with-a-block-chain-network/>

3. Deploy an asset-transfer app using block chain. Learn app development within a Hyperledger Fabric network.
<https://developer.ibm.com/patterns/deploy-an-asset-transfer-app-using-block-chain/>
4. Use block chain to track fitness club rewards Build a web app that uses

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- Hyperledger Fabric to track and trace member rewards.
<https://developer.ibm.com/patterns/fitness-club-rewards-points-iot-and-retail-integration/>
5. Car auction network: A Hello World example with Hyperledger Fabric Node SDK and IBM Block chain Starter Plan. Use Hyperledger Fabric to invoke chaincode while storing results and data in the starter plan.
<https://developer.ibm.com/patterns/car-auction-network-hyperledger-fabric-node-sdk-starter-plan/>
 6. Develop an IoT asset tracking app using Block chain. Use an IoT asset tracking device to improve a supply chain by using Block chain, IoT devices, and Node-RED.
[iot-asset-tracking-app-using-block chain/](https://developer.ibm.com/patterns/iot-asset-tracking-app-using-block-chain/)
Secure art using block chain digital certificates. Node.js-based auction application can help democratize the art market [https://developer.ibm.com/patterns/securing-art-using-block chain-digital-certificates/](https://developer.ibm.com/patterns/develop-an-https://developer.ibm.com/patterns/securing-art-using-block-chain-digital-certificates/)
 1. Mini projects such as :
 - (i) Block chain for telecom roaming, fraud, and overage management.
 - (ii) See how communication service providers use block chain to enhance their value chains.
[https://developer.ibm.com/patterns/block chain-for-telecom-roaming-fraud-and- overagemanagement/](https://developer.ibm.com/patterns/block-chain-for-telecom-roaming-fraud-and-overagemanagement/)
 - (iii) Use IoT dashboards to analyze data sent from a Block chain network.

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Build an IoT app and IoT dashboards with Watson IoT Platform and Node-RED to analyze IoT data sent from a Block chain network.

<https://developer.ibm.com/patterns/iot-dashboards-analyze-data-block-chain-network/>

(iii) Create an Android app with Block chain integration. Build a Block chain enabled health and fitness app with Android and Kubernetes.

(iv) Create a global finance block chain application with IBM Block chain Platform Extension for VS Code. Develop a Node.js smart contract and web app for a Global Finance with blockchain use case

[https://developer.ibm.com/patterns/global-financing-use-case-for-block chain/](https://developer.ibm.com/patterns/global-financing-use-case-for-block-chain/)

(iv) Develop a voting application using Hyperledger and Ethereum. Build a decentralized app that combines Ethereum's Web3 and Solidity smart contracts with Hyperledger's hosting Fabric and Chaincode EVM

<https://developer.ibm.com/patterns/voting-app-hyperledger-ethereum/>

(v) Create a block chain app for loyalty points with Hyperledger Fabric Ethereum Virtual Machine. Deploy Fabric locally with EVM and create a proxy for interacting with a smart contract through a Node.js web app

<https://developer.ibm.com/patterns/loyalty-points-fabric-vm/>

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BTCS606	PW/I	Minor Project	-	-	-	-	100	-	-	4	2

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Course Objectives:

This course is the masters by coursework Minor Project.

A Minor Project is a substantial work of supervised research or development, requiring the equivalent of about four to six months full-time work from start to finish. A Project involves identifying a task or problem, searching and reviewing relevant literature, a proposed, implemented, and critically analyzed solution to the task or problem, and a written report describing the problem, the relevant literature, the solution, and its relation to other work in the area.

Note: This course includes a work integrated learning experience in which your knowledge and skills will be applied and assessed in a real or simulated workplace context and where feedback from industry and/ or community is integral to your experience.

Objectives/Learning

Outcomes/Capability Development

Program Learning Outcomes

This course contributes to the following program learning outcomes:

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- **Enabling Knowledge:**

You will gain skills as you apply knowledge with creativity and initiative to new situations. In doing so, you will:

- Demonstrate mastery of a body of knowledge that includes recent developments in Information Technology
- Recognize and use research principles and methods applicable to Information Technology

- **Critical Analysis**

You will learn to accurately and objectively examine, and critically investigate Information Technology (IT) concepts, evidence, theories or situations, in particular to:

- analyze and model complex requirements and constraints for the purpose of designing and implementing software artifacts and IT systems
- Evaluate and compare designs of software artifacts and IT systems on the basis of organizational and user requirements.

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BTCS606	PW/I	Minor Project	-	-	-	-	100	-	-	4	2

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- **Problem Solving:**

Your capability to analyze complex problems and provide suitable solutions will be extended as you learn to: design and implement software solutions that accommodate specified requirements and constraints, based on analysis or modeling or requirements specification.

- **Communication:**

You will learn to communicate effectively with a variety of audiences through a range of modes and media, in particular to: interpret abstract theoretical propositions, choose methodologies, justify conclusions and defend professional decisions to both IT and non-IT personnel via technical reports of professional standard and technical presentations.

- **Responsibility:**

You will be required to accept responsibility for your own learning and make informed decisions about judging and adopting appropriate behaviour in professional and social situations. This includes accepting the responsibility for independent life-long learning and a high level of accountability. Specifically,

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you will learn to: effectively apply relevant standards, ethical considerations, and an understanding of legal and privacy issues to designing software applications and IT systems.

- **Research and Scholarship:**

You will have technical and communication skills to design, evaluate, implement, analyze and theorize about developments that contribute to professional practice or scholarship; specifically you will have cognitive skills:

- To demonstrate mastery of theoretical knowledge and to reflect critically on theory and professional practice or scholarship
- To plan and execute a substantial research-based project, capstone experience and/or piece of scholarship.

Course Learning Outcomes

- Identify a task or problem relevant to /or IT
- Search and review of the relevant literature

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- Propose a solution to the task or problem
- Develop a software and/or algorithmic solution to the task or problem
- Implement solutions to meet high quality requirements developed by the supervisor
- Carry out research under supervision
- Present the research in a written form like that used for published papers

Overview of Learning Activities

A Minor project is a substantial work of supervised research or software development. You will choose an academic staff member as your supervisor to work on a research project. To successfully complete the course, you must demonstrate research skills: ability to undertake research under supervision, ability to analyze, develop, and present the research in a written form like that used for published papers, and ability to present the research in an oral seminar.

In this course, you are expected to carry out research activities including implementing a complete solution to the problems identified by the supervisor, critical analysis of results, and completing a written Project. The major deadline for this course is the delivery of the Minor Project by the end of the semester.

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Overview of Assessment

You must satisfactorily complete each of the following assessment tasks for this course:

- Research project comprising an implemented and critically analyzed solution to the task or problem
- Written report (final Project) describing the problem, the relevant literature, the solution, and its relation to other work in the area

Seminar on your research (of 20 minutes) soon after your Project is submitted.

The Minor Project is assessed on its merits as a research publication. Each Project is examined by two academics, usually from within the Institute.

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BTCS612	DSE	Simulation and Modeling	60	20	20	30	20	2	1	2	4

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COURSE OBJECTIVES

The student will have ability to:

1. Introduce students to the simulation and modeling techniques.
2. Provide a way for students with opportunities to develop basic simulation and modeling
3. Introduce concepts of modeling layers of society's & industrial real world problems.
4. Build tools to view and control simulations and their results.

COURSE OUTCOMES

On completion of the subject, students will be able to:

1. Characterize a given engineering system in terms of its essential elements, that is, purpose, parameters, constraints, performance requirements, subsystems, interconnections and environmental context.
2. Develop a modeling strategy for a real world engineering system, which considers prediction and evaluation against design criteria, and integrates any required sub-system models.
3. Assess and select a model for an engineering system taking into consideration its suitability to facilitate engineering decision making and predicted advantages over alternative models.
4. Interpret the simulation results of an engineering system model, within the context of its capabilities and limitations, to address critical issues in an engineering project
5. Fundamentals and techniques for designing and using simulation, modeling,

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and optimization algorithms with applications in system performance Modeling, business infrastructure modeling, and distributed and parallel computing. An introduction to advanced complex systems models.

Syllabus

UNIT-I INTRODUCTION

Introduction to simulation & modeling, advantages and disadvantages of simulation, application areas in communication, computer and software design, systems and systems environment, components of a system, discrete and continuous systems, model of a system, types of models, discrete-event simulation, steps in a simulation study. Simulation Examples- Simulation of queueing systems, on-demand and inventory systems, simulation for reliability analysis, Introduction to GPSS.

UNIT-II COMPUTER BASED SYSTEM SIMULATION:

Types of System Simulation, Monte Carlo Method, comparison of analytical and Simulation methods, Markov Model, Numerical Computation techniques for Continuous and Discrete Models, Distributed Lag Models, Cobweb Model. Continuous System models, Analog and Hybrid computers, Digital- Analog

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			THEORY			PRACTICAL		L	T	P	CREDITS
			ENDSEM University Exam	Two Term Exam	Teachers Assessment*	ENDSEM University Exam	Teachers Assessment*				
BTCS612	DSE	Simulation and Modeling	60	20	20	30	20	2	1	2	4

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;
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Simulators, Continuous system simulation languages, Hybrid simulation, Real Time simulations.

UNIT III
INTRODUCTION TO QUEUING THEORY

Characteristics of queuing system, Poisson's formula, birth-death system, equilibrium of queuing system, analysis of M/M/1 queues. Introduction to multiple server Queue models M/M/c
 Application of queuing theory in manufacturing and computer system, FSM, Petri-net Model.

UNIT-IV
VERIFICATION AND VALIDATION

Verification of Simulation Models, Calibration and Validation of Models, Validation of Model Assumptions, Validating Input & Output Transformations, Design of simulation experiments,

UNIT-V
SIMULATION TOOLS

Simulation Tools – Model Input – High level computer system simulation – CPU – Memory, Simulation – Comparison of systems via simulation – Simulation Programming techniques, Development of Simulation models, General Purpose Simulation Package-MATLAB, ARENA, EXTEND, Study of SIMULA, DYNAMO

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TEXT BOOKS:

1. Gordon G., System simulation, PHI Learning
2. Singh V.P System Simulation and Modeling NEW AGE INTERNATIONAL, PUBLISHERS
3. Taha H, Operations Research; PHI.
4. Payer, T., Introduction to system simulation, McGraw Hill.
5. Spriet JA; Computer Aided Modeling and Simulation, Academic Press INC; USA

REFERENCES:

1. Law AM and Kelton WD; Simulation Modeling and Analysis; TMH
2. J K Sharma, Operations Research The and Application, Pearson Education Pvt Ltd, 2 hn Wiley.

List of Practical's:

1. Simulate CPU scheduling algorithm using queuing system.
2. Simulate multiplexer using queuing system.
3. Simulate Network congestion control algorithms using Petri-net Model.
4. Simulate disk scheduling algorithms Petri-net Model.
5. Verification and validation of Petri-net Model.
6. Simulate a Manufacturing shop and write a program in GPSS.
7. Simulate Telephone system model and write a program in SIMSCRIPT.
8. Graphical Simulation and Modeling using MATLAB.

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BTCS612	DSE	Simulation and Modeling	60	20	20	30	20	2	12	4	

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9. Study of SIMULA
10. Study of DYNAMO

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BTCS613	DSE	Software Testing and Quality Assurance	60	20	20	30	20	2	1	2	4

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COURSE OBJECTIVES

The student will have ability to:

1. Develop a skill in developing good quality in the software product.
2. Develop methods and procedures for software development that can scale up for large systems and that can be used to consistently produce high-quality software at low cost and with a small cycle time
3. Learn systematic approach to the operation, maintenance, and retirement of software.
4. Learn how to use available resources to develop software, reduce cost of software and how to maintain quality of software
5. Methods and tools of testing and maintenance of software

COURSE OUTCOMES

Upon completion of the subject, students will be able to:

1. Apply approach of Software Testing & QA concepts.
2. Apply modern software testing processes in relation to software development and project management.
3. Create test strategies and plans, design test cases prioritize and execute them.
4. Manage defects within a project.
5. Contribute to efficient delivery of software solutions and implement improvements in the software development processes.

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SYLLABUS

UNIT-I

BASIC CONCEPTS: Basic Testing Vocabulary, Quality Assurance versus Quality Control, The Cost of Quality, Software Quality Factors, Software Defect, The Multiple Roles of the Software Tester (people relationship) scope of testing Testing Constraints, Various software development life cycles(SDLC), independent testing QA Process, Levels of Testing, The “V” Concept of Testing.

UNIT-II

WHITE BOX TESTING: White box testing techniques - Statement coverage - Branch Coverage - Condition coverage - Decision/Condition coverage - Multiple condition coverage - Dataflow coverage
 - Mutation testing - Automated code coverage analysis.

UNIT-III

BLACK BOX TESTING: Black box testing techniques - Boundary value analysis - Robustness testing - Equivalence partitioning -Syntax testing - Finite state testing - Levels of testing – Unit testing- Integration Testing

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UNIT-IV

SYSTEM TESTING - Functional testing-non-Functional testing-acceptancetesting-performance testing –Factors and Methodology for Performance testing, Regression testing-Methodology for Regression-testing.Five Views of Software Quality, McCall’s Quality Factors and Criteria, Quality Factors, Quality Criteria, Relationship between Quality Factors and Criteria, Quality Metrics, Quality Characteristics, Software Quality Standard

UNIT-V

ADVANCE SOFTWARE TESTING METHOD (OBJECT ORIENTED TESTING): Syntax testing - Finite State testing - Levels of testing - Unit, Integration and System Testing. Challenges - Differences from testing non-OO Software - Class testing strategies - State-based Testing Software quality Assurance: ISO 9000; CMM and Test Management Issues; Quality Assurance personnel Issues

TEXTBOOKS:

- 1.KshirasagarNaik&PriyadarshiTripathy, “Software Testing & Quality Assurance”, A JOHN WILEY & SONS, INC. Publication.
2. R S. Pressman ,”Software Engineering: A Practitioner's Approach”, Sixth edition 2006, McGraw- Hill.

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***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks

3. Waman S. Jawadekar, "Software Engineering", TMH
4. Sommerville, "Software Engineering", Pearson Education.
5. "IBM CE-Enablement Program- Essentials of Software Engineering (OOAD & SW Lifecycle)", IBM Career Education

REFERENCES:

1. Kshirasagar Naik & Priyadarshi Tripathy, "Software Testing & Quality Assurance", A JOHN WILEY & Sons Publication
2. R S Pressman Practitioner's Approach", Sixth edition 200 Hill.

List of Practical's: (At least 10 based on Syllabus)

1. Design test cases using Boundary value analysis by taking quadratic equation problem.
2. Design test cases using Equivalence class partitioning taking triangle problem.
3. Design test cases using Decision table taking triangle problem.

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4. Design independent paths by calculating cyclometer complexity using date problem.
5. Design independent paths by taking DD path using date problem.
6. Design the test cases for login page of AMIZONE.
7. Manual Testing for PAN card verification
8. Generate test case for ATM machine.
9. Overview of Testing process using Rational Robot.
10. Write a script to record verification point using Rational Robot (For GUI testing of single click on window OS).
11. Write a script to record verification point for Clip Board and alphanumeric values using Rational Robot.

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BTCS617	DSE	Robotics	60	20	20	30	20	2	1	2	4

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COURSE OBJECTIVES

1. The objective of this course is to impart knowledge about industrial robots for their control and design.

COURSE OUTCOMES

Upon completion of the subject, students will be able to:

1. Perform kinematic and dynamic analyses with simulation.
2. Design control laws for a robot.
3. Integrate mechanical and electrical hardware for a real prototype of robotic device.
4. Select a robotic system for given application.

SYLLABUS

UNIT-I

Introduction to Robotics: Types and components of a robot, Classification of robots, closed-loop and open-loop control systems.

Kinematics systems; Definition of mechanisms and manipulators, Social issues and safety

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UNIT-II

Robot Kinematics and Dynamics: Kinematic Modelling: Translation and Rotation Representation, Coordinate transformation, DH parameters, Jacobian, Singularity, and Statics
Dynamic Modelling: Equations of motion: Euler-Lagrange formulation

UNIT-III

Sensor and Vision System: Sensor Contact and Proximity, Position, Velocity, Force, Tactile etc; Introduction to Cameras, Camera calibration, Geometry of Image formation, Euclidean/Similarity /Affine/Projective transformations. Vision applications in robotics.

UNIT-IV

Robot Control: Basics of control: Transfer functions, Control laws: P, PD, PID. Non-linear and advanced controls.

UNIT-V

Robot Actuation Systems: Actuators: Electric, Hydraulic and Pneumatic; Transmission: Gears, Timing Belts and Bearings, Parameters for selection of actuators.

Control Hardware and Interfacing: Embedded systems: Architecture and integration with sensors, actuators, components, Programming for Robot Applications.

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TEXT BOOKS:

1. Saha, S.K., “Introduction to Robotics, 2nd Edition, McGraw-Hill Higher Education, New Delhi, 2014.
2. Ghosal, A., “Robotics”, Oxford, New Delhi, 2006.
3. Niku Saeed B., “Introduction to Robotics: Analysis, Systems, Applications”, PHI, New Delhi.
4. Mittal R.K. and Nagrath I.J., “Robotics and Control”, Tata McGraw Hill.
5. Mukherjee S., “Robotics and Automation”, Khanna Publishing House, Delhi.
6. Craig, J.J., “Introduction to Robotics: Mechanics and Control”, Pearson, New Delhi, 2009
7. Mark W. Spong, Seth Hutchinson, and M. Vidyasagar, “Robot Modelling and Control”, John Wiley and Sons Inc, 2005
8. Steve Heath, “Embedded System Design”, 2nd Edition, Newnes, Burlington, 2003.
9. Merzouki R., Samantaray A.K., Phathak P.M. and Bouamama B. Ould, “Intelligent Mechatronic System: Modeling, Control and Diagnosis”, Springer.

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List of Practical's:

1. Study components of a real robot and its DH parameters.
2. Forward kinematics and validate using a software (Robo Analyser or any other free software tool).
3. Inverse kinematics of the real robot and validation using any software.
4. Use of open source computer vision programming tool openCV.
5. Image Processing using openCV.
6. Image Processing for color/shape detection.
7. Positioning and orientation of robot arm.
8. Control experiment using available hardware or software.
9. Integration of assorted sensors (IR, Potentiometer, strain gages etc.), micro controllers and ROS (Robot Operating System) in a robotic system.
10. Project work

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BTCS603	DCC	Cloud Engineering	60	20	20	30	20	3	0	2	4

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COURSE OBJECTIVES

The student will have ability to:

1. Analyze the SAAS, PAAS IAAS services of Cloud Computing to represent how engineering agility in an organization can be created.
2. Assess the exploitation of web services from cloud computing.
3. Configure essential infrastructural components used for implementing Cloud.
4. Understand the evolution and impact of cloud computing in the world today.

COURSE OUTCOMES

Upon completion of the subject, students will be able to:

1. Investigate the trade-offs among deploying applications in the cloud and over the local infrastructure.
2. Compute the real-world problems security, privacy issues using cloud computing through group collaboration.
3. Development and Deployment applications over commercial cloud computing infrastructures.
4. Understand how deep our industries and societies rely on the cloud computing global

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infrastructure.

Syllabus:

UNIT I

General Cloud Concepts: What is Cloud Computing: Meaning of cloud, Cloud Services, Virtualization, Grid Computing

Cloud Service Attributes: Access to the Cloud, Cloud Hosting, Information Technology Support, Provisioning, Pricing, User Interface, System Interface, Shared Resources/Common Versions

Characteristics of Cloud Computing: Rapid elasticity, Pay per use, Independent resource pooling,

Load Balancing, Network access, On-demand self-service, The Five Levels of Redundancy, Measured Service, Virtual resource, Availability zone, Region

UNIT II

Cloud Categories: Public Cloud, Private Cloud, Hybrid Cloud, Multi Cloud vs Hybrid Cloud, OpenStack/OpenShift, ECP Architecture & IaaS/PaaS/XPaaS/CICD realization, Community Cloud

Cloud Delivery Models: SaaS, PaaS, IaaS, Design for Failure (DFF), Traditional, Customization

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Cloud Architectural Models: Service Reliability and Disruptions, Loss of Control, Emerging Technology, Vendor Choices (Comparison of AWS, Azure , GCP, Ali cloud)

Integration Challenges: Infrastructure Limitations, Negligence, Advantages, Savings, Benefits

UNIT III

AWS General Services: AWS: Cloud computing and Top cloud providers, Service offerings (Paas, Iaas, SaaS), Regions and Availability Zones, Understand pricing model

IAM: IAM as centralized Access Management, Security Credentials, Access Keys and Key Pairs, Identities (Users, Groups, Roles), Manage IAM policies and permissions for Identities, Create delegated IAM User and assign privileges to access S3 and EC2

EC2: Scalable computing with EC2, Instances types and AMIs, Instance Lifecycle, EBS and Root device volume , Create and Launch EC2 instance, Access EC2 Instances through CLI and API, what is internal IP, static IP, public IP , Monitoring, Load Balancing, Auto Scaling and Elastic IP, Deploy simple web application on single node, Deploy simple web application on multiple nodes, configure ELB and access the web application using ELB, Autoscale web application and test/assert based on policies

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UNIT IV

AWS Data & Integration: Data Lake: Object based storage and Key fundamentals, Access management and Security, Lifecycle Management, Storage classes and Glacier, Create a bucket and explore operations on object,

Encryption options for data stored on S3

Integration: Lambda- Building server less architecture with Lambda, Lambda concepts and Limitations, Lambda functions - configuration and invocation, Types of all Synchronous and Asynchronous event invocations supported, Supported Development Languages, Develop, configure and Use a Lambda, Integration with other services

SNS- What is SNS and How it works ?, Core components of SNS (Publisher/Subscriber and Topics), Integrate other services with SNS, Invoke Lambda function using SNS notification

SQS- What is SQS and How it works ?, Difference between SNS and SQS, What is Queue and its Types ?, Understanding Integration Patterns, Create a SQS Queue, Create and Subscribing SQS Queue to SNS Topic

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UNIT V

Monitoring & Advanced Services: CloudWatch: How CloudWatch Works, Monitoring Instances Using CloudWatch, Understanding Metrics and Alarms, Create a Cloud Watch alarm to trigger a lambda function, Analyze MR job performance from EMR cloud metrics

Networking: understand security groups, Network ACLs, VPC, Connectivity between on-premise to VPC, VPC Peering, DirectConnect, VPN, Internet Gateway, NAT, Bastion hosts, Routing - DNS, Route 53, A Record, Routing policies, CDN (CloudFront)

Security: understand shared security model

TEXT BOOKS :

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5. <https://www.abacusnext.com/blog/whats-difference-between-public-private-hybrid-and-community-clouds>
6. <https://www.cloudtp.com/doppler/hybrid-cloud-vs-multi-cloud-whats-difference-matter/>
7. https://linuxhint.com/openshift_vs_openstack/

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