



**Shri Vaishnav Vidyapeeth Vishwavidyalaya**  
**Bachelor of Technology (CSE with Specialization in Enterprise System (Red Hat))**  
**Choice Based Credit System (CBCS)-2018-19**

**SEMESTER-VI**

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment	END SEM University Exam	Teachers Assessment				
<b>BTCS501</b>	<b>UG</b>	<b>Theory of Computation</b>	<b>60</b>	<b>20</b>	<b>20</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>

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

\*Teacher Assessment shall be based following components: Quiz/Assignment/ 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.

#### 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, Pumping Lemma for regular Languages. Application of Pumping Lemma, Closure properties of Regular Languages, Decision properties of Regular Languages, FA with output: Moore and Mealy machine, Equivalence of Moore and Mealy Machine, Applications and Limitation of FA.



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**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.

**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, 3<sup>rd</sup> edition, 2014
2. Peter Linz, "An Introduction to Formal Language and Automata", Narosa Pub. House, 2011.
3. K.L.P Mishra & N.Chandrasekaran, "Theory of Computer Science", PHI Learning, 3<sup>rd</sup> edition, 2006

**REFERENCES:**

1. Martin J. C., "Introduction to Languages and Theory of Computations", TMH, 4<sup>th</sup> 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, 3<sup>rd</sup> edition, 2013



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<b>BTCS608</b>	<b>UG</b>	<b>Data Science</b>	<b>60</b>	<b>20</b>	<b>20</b>	<b>30</b>	<b>20</b>	<b>3</b>	<b>0</b>	<b>2</b>	<b>4</b>

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**COURSE OBJECTIVES**

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.

**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, Simpson's Paradox, Correlation and Causation, Probability: Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables, Continuous



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**SEMESTER-VI**

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.

**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

**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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			END SEM University Exam	Two Term Exam	Teachers Assessment	END SEM University Exam	Teachers Assessment				
BTIT603	UG	Cyber and Network Security	60	20	20	30	20	3	-	2	4

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**COURSE OBJECTIVES:**

The student will have ability:

1. To gain a fundamental knowledge of Cyber crime and Network Security.
2. To gain a fundamental understanding of a Cyber-attack and Challenges in identify and prevent them from occurring.
3. To gain a fundamental knowledge of Tools and Methods used in Cyber crime for prevention.
4. To understand the need of Cyber law and the fundamental concepts of Cyber Forensic.
5. To provide the fundamental skills and understanding needed to identify Cyber Security threats.

**COURSE OUTCOMES:**

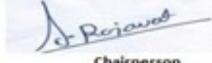
Upon completion of the subject, students will be able to:

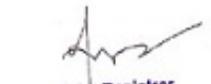
1. Identify physical points of vulnerability in simple networks and security needs of an organization.
2. Evaluate the Legal Perspective of Cyber crime and Cyber Security.
3. Formulate, update and communicate short- and long-term organizational cyber-security strategies and policies.
4. Troubleshoot, maintain and update an enterprise-level information security system.
5. Investigate the Cybercrime with the help of Cyber Forensic.

**SYLLABUS**

**UNIT-I**

Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security mechanism, Fundamental Security Design Principles, Attack Surface and Attack trees, A Model for Network Security.

  
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**SEMESTER-VI**

Introduction to Cyber crime, Cyber crime and Information Security, Classification of Cyber crimes, Cyber crime: The Legal Perspective, Cyber crime: An Indian Perspective.

**UNIT-II**

Introduction to Cyber offence, How Criminal plan the attack, Social Engineering, Cyber stalking, Cyber café and cyber crime, Botnets: The fuel of cybercrime, Attack vector, cloud computing. Cyber crime: Mobile and Wireless devices, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Setting for Mobile Devices, Authentication Service Security, Attack on Mobile Phones.

**UNIT-III**

Tools and Methods Used in Cyber crime, Proxy Server and Anonymizers, Phishing and Identity Theft, Password Cracking, Keylogger and Spyware, Virus and Worms, Trojan Horse and Backdoors, Steganography DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attack on Wireless Networks.

**UNIT-IV**

Cyber crime and the Legal Landscape around the World, Why Do We Need Cyber laws, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario in India, Information Technology Act, Digital Signature and the IT Act, Cybercrime and Punishment.

Introduction to Cyber Forensics, Historical Background of Cyber Forensics, Cyber Forensics and Digital Evidence, Forensic Analysis of E-Mail, Digital Forensic Life Cycle, Approaching Computer Forensic Investigation, Relevance of OSI Model to Computer Forensic, Challenges in Computer Forensic.

**UNIT-V**

Network Access Control and Cloud Security, Transport- Level Security, Wireless Network Security, Electronic Mail Security, IP Security.

**TEXT BOOKS:**

1. William Stallings, "Cryptography and Network Security: Principles and Practice", 7th Edition Pearson, 2017
2. Sunit Belapure, Nina Godbole "Cyber Security", 1st edition, Wiley Publication, 2011

**REFERENCES:**

1. Carl Endorf, Eugene Schultz, Jim Mellander "Intrusion Detection & Prevention", 1<sup>st</sup> Edition, TMH, 2007
2. Neal, Krawetz, Introduction to Network Security, 1st Edition, Cengage Learning, 2006
3. Atul Kahate, "Cryptography and Network Security", McGraw Hill, 2009
4. Charlie Kaufman, Radia Perlman, Mike Speciner, Michael Speciner, "Network Security - Private communication in a public world", 2nd Edition, TMH, 2002
5. Fourozon, "Cryptography & Network Security" 4th Edition, TMH, 2005
6. Mayank Bhushan "Fundamentals of Cyber Security", 1st Edition, BPB Publication, 2017
7. Gaurav Gupta, Sarika Gupta "Information Security and Cyber Laws", 1st Edition, Khanna Book



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**SEMESTER-VI**

Publishing, 2011.

**List of Practical's:**

Atleast 10 experiments Based on the syllabus

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<b>BTCS618</b>	<b>UG</b>	<b>Block Chain</b>	<b>60</b>	<b>20</b>	<b>20</b>	<b>30</b>	<b>20</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>4</b>

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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 block chain technology in different perspectives.

**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**



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**SEMESTER-VI**

**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.

**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”.
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, Venkatraman. Ramakrishna, “Hands-On Block Chain with Hyperledger: Building Decentralized Applications with Hyperledger Fabric and Composer”, Import, 2018



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**SEMESTER-VI**

**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/>  
<https://docs.docker.com/get-started/><https://console.ng.bluemix.net/docs/services/blockchain/index.html>  
[https://console.bluemix.net/docs/containers/container\\_index.html#container\\_index](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/>
3. 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/>
4. 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/>
5. Use block chain to track fitness club rewards Build a web app that uses Hyperledger Fabric to track and trace member rewards.  
<https://developer.ibm.com/patterns/fitness-club-rewards-points-iot-and-retail-integration/>
6. 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/>
7. 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.  
<https://developer.ibm.com/patterns/develop-an-iot-asset-tracking-app-using-block-chain/>
8. 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/>
9. Mini projects such as :
  - (i) Block chain for telecom roaming, fraud, and overage management. 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/>
  - (ii) Use IoT dashboards to analyze data sent from a Block chain network. 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.  
<https://developer.ibm.com/patterns/create-an-android-app-with-block-chain-integration/>



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**SEMESTER-VI**

(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 block chain 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/)

(v) 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/>

(vi) 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-ethereum/>



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			THEORY				PRACTICAL		L	T	P	CREDITS
			SEM	University	Two Term	Final	SEM	University				
DOJB603	UG	Introduction to container Kubernete and RedHat OpenShift and JBOSS	-	-	-	-	-	100	-	-	4	2

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**Description:** Learn to build and manage containers for deployment on a Kubernetes and Red Hat OpenShift cluster. Develop microservice-based applications in Java EE with MicroProfile and OpenShift.

**Course Objectives:**

- Understand container and OpenShift architecture.
- Deploy containerized applications on Red Hat OpenShift.
- Create, Deploy and monitor microservice-based applications.
- Implement unit and integration tests for microservices.
- Secure a microservice using the JSON Web Token (JWT) specification

**Course Outcomes:**

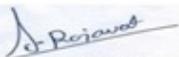
- Manage containers and container images.
- Deploy multi-container applications.
- Design a microservices-based architecture for an enterprise application.
- Implement fault tolerance and health checks for microservices.
- Secure microservices to prevent unauthorized access.

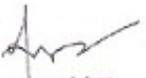
**Syllabus**

**Introduce container technology**

Describe how software can run in containers orchestrated by Red Hat OpenShift Container Platform.

**Create containerized services**

  
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**SEMESTER-VI**

Provision a server using container technology.

**Manage containers**

Manipulate pre-built container images to create and manage containerized services.

**Manage container images**

Govern the life cycle of a container image from creation to deletion.

**Create custom container images**

Design and code a Docker file to build a custom container image.

**Deploy containerized applications on Red Hat OpenShift**

Use single container applications on Red Hat OpenShift Container Platform.

**Deploy multi-container applications**

Set up applications that are containerized using multiple container images.

**Troubleshoot containerized applications**

Regulate a containerized application deployed on Red Hat OpenShift.

**Comprehensive review of curriculum**

Demonstrate how to containerize a software application, test it with Podman, and deploy it on a Red Hat OpenShift cluster.

**Describe microservice architectures**

Describe components and patterns of microservice-based application architectures.

**Deploy microservice-based applications**

Deploy portions of the course case study applications on an OpenShift cluster.

**Implement a microservice with MicroProfile**

Describe the specifications in MicroProfile, implement a microservice with some of the specifications, and deploy it to an OpenShift cluster.

**Test microservices**

Implement unit and integration tests for microservices.

**Inject configuration data into a microservice**

Inject configuration data from an external source into a microservice.

**Create application health checks**

Create a health check for a microservice.

**Implement fault tolerance**

Implement fault tolerance in a microservice architecture.

**Develop an API gateway**

Describe the API gateway pattern and develop an API gateway for a series of microservices.

**Secure microservices with JWT**

Secure a microservice using the JSON Web Token specification.

**Monitor microservices**

Monitor the operation of a microservice using metrics, distributed tracing, and log aggregation.

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Shri Vaishnav Vidyapeeth Vishwavidyalaya  
Indore



**Shri Vaishnav Vidyapeeth Vishwavidyalaya**  
**Bachelor of Technology (CSE with Specialization in Enterprise System (Red Hat))**  
**Choice Based Credit System (CBCS)-2018-19**

**SEMESTER-VI**

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment	END SEM University Exam	Teachers Assessment				
BTCS606	-	Minor Project	-	-	-	-	100	-	-	4	2

**Legends:** L-Lecture; T-Tutorial/Teacher Guided Student Activity; P-Practical; C-Credit; Q/A-Quiz/Assignment/Attendance, MST Mid Semester Test.

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

**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 skill 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:

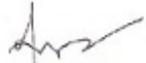
- **Enabling Knowledge:**

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:**

  
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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.
- **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, 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**

Upon successful completion of this course you should be able to:



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- Identify a task or problem relevant to /or IT
- Search and review of the relevant literature
- 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
- Present the research in an oral seminar.

**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.

**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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			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam Teachers Assessment	END SEM University Exam Teachers Assessment *	L	T	P	CREDITS		
BTCS612	UG	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;

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

### 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, 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

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**SEMESTER-VI**

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 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**

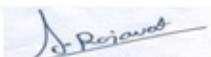
Simulation Tools – Model Input – High level computer system simulation – CPU – Memory, Simulation – Comparison of systems via simulation – Simulation Programming techniques, Development of Simulation models, General Purpose Simulation Package-MATLAB, ARENA, EXTEND, Study of SIMULA, DYNAMO

**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. J K Sharma, Operations Research Theory and Application, Pearson Education Pvt Ltd, 2 Edition  
Banks J; Hand book of Simulation; John Wiley.

  
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**SEMESTER-VI**

2. Law AM and Kelton WD; Simulation Modeling and Analysis; TMH

**List of Practical's:**

1. Simulate CPU scheduling algorithm using queueing system.
2. Simulate multiplexer using queueing 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.
9. Study of SIMULA.
10. Study of DYNAMO.

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			THEORY			PRACTICAL		L	T	P	CREDITS
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BTCS613	UG	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.

### 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 Relationships), Scope of Testing, Testing Constraints, Various software development Life cycles (SDLC), Independent Testing, QA Process, Levels of Testing, The “V” Concept of Testing



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**SEMESTER-VI**

**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

**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**

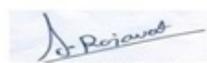
**ADVANCE SOFTWARE TESTING METHOD (OBJECT ORIENTED TESTING):** Syntax testing - Finite State testing - Levels of testing - Unit, Integration and System Testing. Challenges - Differences from testing non-OO Software - Class testing strategies - State-based Testing Software quality Assurance: ISO 9000;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

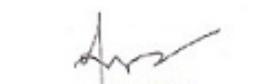
**TEXT BOOKS:**

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

**REFERENCES:**

- 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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3. Waman S. Jawadekar, "Software Engineering", TMH
4. Sommerville, "Software Engineering", Pearson Education.
5. <http://www.softwaretestinghelp.com/online-software-testing-course-syllabus/>
6. <https://amizone.net/AdminAmizone/WebForms/Academics/NewSyllabus/1217201473127725.pdf>
7. <http://www.tutorialspoint.com/uml/>

**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.
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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			END SEM	Two Term	Teachers Assessm	SEM	Teachers Assessm				
BTCS617	UG	Robotics	60	20	20	30	20	2	1	2	4

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### COURSE OBJECTIVES

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.

#### 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

**Sensors and Vision System:** Sensor: Contact and Proximity, Position, Velocity, Force, Tactile etc.



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**SEMESTER-VI**

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.

**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.

**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