

**Shri Vaishnav Vidyapeeth Vishwavidyalaya**  
**Shri Vaishnav Institute Of Information Technology**  
**Choice Based Credit System (CBCS) in the light of NEP-2020**  
**B.Tech. (CSE - Big Data and Cloud Engineering – Impetus Technologies)**  
**SEMESTER-VI(2021-2025)**

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME					L	T	P	CREDITS
			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
<b>BTCS601 N</b>	<b>DCC</b>	<b>Compiler Design</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:**

- To introduce the major concept areas of language translation and compiler design
- To enrich the knowledge in various phases of compiler and its use
- To provide understanding of steps of programming necessary for constructing a compiler

**Course Outcomes:**

- Ability to apply the knowledge of lex tool & yacc tool to develop a scanner & parser
- Ability to design and develop software system for backend of the compiler
- Ability to comprehend and adapt to new tools and technologies in compiler design

**Syllabus**

**Unit – I:**

**8 Hours**

**Introduction:** Compiler, Compilers analysis of the source program, Phases of a compiler, Cousins of the Compiler, Grouping of Phases and Compiler construction tools, Lexical Analysis, Role of Lexical Analyzer, Input Buffering and Specification of Tokens.

**Unit – II:**

**10 Hours**

**Syntax Analysis:** Role of the parser, Writing Grammars, Context-Free Grammars, Top Down parsing, Recursive Descent Parsing, Predictive Parsing, Bottom-up parsing, Shift Reduce Parsing, Operator Precedent Parsing, LR Parsers, SLR Parser – Canonical LR Parser – LALR Parser.

**Unit – III:**

**9 Hours**

**Intermediate Code Generation:** Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Intermediate languages, Declarations, Assignment Statements, Boolean Expressions, Case Statements, Three Address code, Back patching, Procedure calls.

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**Unit – IV:**

**10 Hours**

**Code Optimization and Run Time Environments:** Introduction, Principal Sources of Optimization, Optimization of basic Blocks, DAG representation of Basic Blocks - Introduction to Global Data Flow Analysis, Runtime Environments, Source Language issues, Storage Organization, Storage Allocation strategies, Access to non-local names, Parameter Passing, Error detection and recovery.

**Unit – V:**

**9 Hours**

**Code Generation:** Issues in the design of code generator, The target machine, Runtime Storage management, Basic Blocks and Flow Graphs, Next-use Information, A simple Code generator, Peephole Optimization.

**Text Books:**

1. Alfred V. Aho, Jeffrey D Ullman, “Compilers: Principles, Techniques and Tools”, Pearson Education Asia, 2012
2. Jean Paul Tremblay, Paul G Serenson, "The Theory and Practice of Compiler Writing", BS Publications, 2005
3. Dhamdhare, D. M., "Compiler Construction Principles and Practice", 2nd edition, Macmillan India Ltd., New Delhi, 2008

**References:**

1. Allen I. Holub, “Compiler Design in C”, Prentice Hall of India, 2003
2. C. N. Fischer and R. J. LeBlanc, “Crafting a compiler with C”, Benjamin Cummings, 2003
3. Henk Alblas and Albert Nymeyer, “Practice and Principles of Compiler Building with C”, PHI, 2001
4. Kenneth C. Loudon, “Compiler Construction: Principles and Practice”, Thompson Learning, 2003

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**List of Experiments:**

1. To study the Lex Tool.
2. To study the Yacc Tool.
3. Write a program to implement Lexical Analyzer to recognize few patterns of C.
4. Write a program to implement the Recursive Descent Parser.
5. Write a program to implement the Computation of FIRST and FOLLOW of variables of grammar.
6. Write a program to compute the leading and trailing symbols of grammar.
7. Write a program to implement Operator Precedence Parser.
8. Write a program to implement SLR parser.
9. Write a program to check the data types.
10. Write a program to implement the generation of three address code.
11. Write a program to implement the computation of postfix notation.
12. Write a program to implement the computation of Quadruple.

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**COURSE OBJECTIVES:**

1. To learn the concept of Object Oriented Software Development Process
2. To get acquainted with UML Diagrams
3. To understand Object Oriented Analysis Processes

**COURSE OUTCOMES:**

1. Understand Object Oriented Software Development Process
2. Gain exposure to Object Oriented Methodologies & UML Diagrams
3. To apply Object Oriented Analysis Processes for projects

**SYLLABUS**

**UNIT-I**

**10 HOURS**

**Introduction:** About Object Oriented Technology, Development and OO Modeling History. Modeling Concepts: Modeling design Technique, Three models, Class Model, State model and Interaction model.

**UNIT-II**

**9 HOURS**

**Class Modeling:** Object and class concepts, link and association, Generalization and Inheritance, Advanced class modeling- aggregation, Abstract class meta data, constraints. State Modeling: Event, state, Transition and conditions, state diagram, state diagram behavior, concurrency, Relation of Class and State models. Interaction Modeling: Use case Models, sequence models, activity models

**UNIT-III**

**8 HOURS**

**Analysis and Design:** Development Life cycle, Development stages, Domain Analysis-Domain class model, domain state model, domain interaction model, Iterating and analysis. Application Interaction model, Application class model, Application state Model, Adding operation.

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**UNIT-IV**

**7 HOURS**

**System Design:** Estimating Performance, Making a reuse plan, breaking system into sub systems identifying concurrency, allocation of subsystems, management of data storage, Handling Global resources, choosing a software control strategy, Handling boundary condition, common Architectural style.

**UNIT-V**

**8 HOURS**

**Class design:** Overview of class design, designing algorithms recursing downward, refactoring, design optimization, Adjustment of Inheritance, Rectification of Behavior.

**TEXT BOOKS:**

1. Michael Blaha and J. Rumbaugh, “Object oriented Modeling and design with UML”, Pearson Education

**REFERENCES:**

1. Satzinger, Jackson and Burd, “Object oriented Analysis and design with the Unified Process”, CENGAGE Learning.
2. O’Docherty, “Object Oriented Analysis and Design Understanding, System Development with UML2.0”, Wiley India.

**LIST OF EXPERIMENTS**

1. How to write a Problem Statement
2. Perform the system analysis: Requirement analysis, SRS.
3. Perform the function oriented diagram: DFD and Structured chart.
4. Perform the user’s view analysis: Use case diagram.

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5. Draw the structural view diagram: Class diagram, object diagram.
6. Draw the behavioral view diagram: Sequence diagram, Collaboration diagram.
7. Draw the behavioral view diagram: State-chart diagram, Activity diagram.
8. Draw the implementation view diagram: Component diagram.
9. Draw the environmental view diagram: Deployment diagram.

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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

### 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.

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### 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, 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, Auto scale web application and test/assert based on policies.

### 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.

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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.

**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, Direct Connect, VPN, Internet Gateway, NAT, Bastion hosts, Routing - DNS, Route 53, A Record, Routing policies, CDN (CloudFront) Security: understand shared security model.

**TEXTBOOKS:**

1. Cloud Computing: A Practical Approach by Anthony T. Velte Toby J. Velte,
2. Robert Elsenpeter, 2010 by The McGraw-Hill.
3. Buyya, Selvy, "Mastering Cloud Computing", TMH Pub.
4. Michael Miller, Cloud computing – Web based Applications, Pearson, Publishing, 2011

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2. <https://www.skyhighnetworks.com/cloud-security-blog/what-is-a-cloud-service/>
3. <https://data-flair.training/blogs/virtualization-in-cloud-computing/>
4. <https://data-flair.training/blogs/grid-computing-vs-cloud-computing/>
5. <https://www.oreilly.com/library/view/practical-cloud-security/9781492037507/ch04.html>
6. <https://blog.resellerclub.com/6-benefits-of-moving-to-cloud-hosting/>
7. <https://www.hindawi.com/journals/tswj/2014/894362/>
8. <https://towardsdatascience.com/pricing-on-the-cloud-9a2d3f61b67f>
9. <https://searchcloudcomputing.techtarget.com/feature/7-key-characteristics-of-cloud-computing>
10. <https://data-flair.training/blogs/features-of-cloud-computing/>
11. <https://link.springer.com/content/pdf/10.1186%2Fs13677-016-0066-8.pdf>
12. <https://www.cvm.com/redundancy-in-the-cloud/>
13. <https://azure.microsoft.com/en-us/overview/what-are-private-public-hybrid-clouds>
14. <https://www.abacusnext.com/blog/whats-difference-between-public-private-hybrid-and-community-clouds>
15. <https://www.cloudtp.com/doppler/hybrid-cloud-vs-multi-cloud-whats-difference-matter/>
16. [https://linuxhint.com/openshift\\_vs\\_openstack/](https://linuxhint.com/openshift_vs_openstack/)

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**Choice Based Credit System (CBCS) in the light of NEP-2020**  
**B.Tech. (CSE - Big Data and Cloud Engineering – Impetus Technologies)**  
**SEMESTER-VI(2021-2025)**

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME					L	T	P	CREDITS
			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
<b>BTDSE611N</b>	<b>DSE</b>	<b>Block Chain</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>

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

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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 indifferent perspectives.

**SYLLABUS:**

**UNIT-I**

**10 Hours**

**Introduction:** Overview of Block chain, Public Ledgers, Bitcoin, Smart Contracts, Block in a Blockchain, Transactions, Distributed Consensus, Public vs Private Block chain, Understanding Cryptocurrency 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**

**10 Hours**

**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.

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**Working with Consensus in Bitcoin:** Distributed consensus in open environments, Consensus in a Bitcoin network, Proof of Work (PoW) – basic introduction, HashcashPoW, 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**

**9 Hours**

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

**UNIT–IV**

**8 Hours**

**Enterprise application of Block chain:** Cross border payments, Know Your Customer (KYC), FoodSecurity, Mortgage over Block chain, Block chain enabled Trade, We Trade – Trade FinanceNetwork, Supply Chain Financing, Identity on Block chain.

**UNIT–V**

**8 Hours**

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

**TEXT BOOKS:**

- Melanie Swan, “Block Chain: Blueprint for a New Economy”, O’Reilly, 2015.

**REFERENCES:**

- Josh Thompsons, “Block Chain: The Block Chain for Beginners- Guide to Block chainTechnology and Leveraging Block Chain Programming”.
- Daniel Drescher, “Block Chain Basics”, Apress; 1stedition, 2017.

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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. Anshul Kaushik, “Block Chain and Crypto Currencies”, Khanna Publishing House, Delhi.
4. Imran Bashir, “Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained”, Packt Publishing.
5. Ritesh Modi, “Solidity Programming Essentials: A Beginner’s Guide to Build SmartContracts for Ethereum and Block Chain”, Packt Publishing.
6. 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

**LIST OF PRACTICALS:**

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 torun.  
<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/](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 chainnetwork by creating an app to test the network and its rules.  
[https://developer.ibm.com/patterns/interacting-with-a-block chain-network/](https://developer.ibm.com/patterns/interacting-with-a-block-chain-network/)
4. Deploy an asset-transfer app using block chain. Learn app development within aHyperledger Fabric network.  
[https://developer.ibm.com/patterns/deploy-an-asset-transfer-app-using-block chain/](https://developer.ibm.com/patterns/deploy-an-asset-transfer-app-using-block-chain/)
5. Use block chain to track fitness club rewardsBuild 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/>

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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/](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/](https://developer.ibm.com/patterns/securing-art-using-block-chain-digital-certificates/)
9. Mini projects such as :
10. 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/](https://developer.ibm.com/patterns/block-chain-for-telecom-roaming-fraud-and-overagemanagement/)
11. 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/](https://developer.ibm.com/patterns/iot-dashboards-analyze-data-block-chain-network/)
12. 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/](https://developer.ibm.com/patterns/create-an-android-app-with-block-chain-integration/)
13. 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/)

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14. 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/>

15. 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

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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

**8 Hours**

**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

**8 Hours**

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

#### UNIT-III

**9 Hours**

**Sensors 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

**8 Hours**

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

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**UNIT–V**

**9 Hours**

**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, 2<sup>nd</sup> Edition, McGraw-Hill Higher Education, NewDelhi, 2014.

**REFERENCES:**

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

**LIST OF PRACTICALS:**

1. Study components of a real robot and its DH parameters.
2. Forward kinematics and validate using a software (Robo Analyser or any other freesoftware tool).
3. Inverse kinematics of the real robot and validation using any software.

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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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<b>BTDSE613 N</b>	DSE	<b>Data Mining And Visualization</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**

\***Inprocess**

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<b>BTCS607N</b>	<b>PW</b>	<b>Minor Project</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>60</b>	<b>40</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

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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 skillswill be applied and assessed in a real or simulated workplace context and where feedback from industry and/ or community is integral to your experience.

### COURSE OUTCOMES

This course contributes to the following program learning outcomes:

- **EnablingKnowledge:**

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 InformationTechnology.

- **CriticalAnalysis:**



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**SEMESTER-VI(2021-2025)**

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			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
<b>BTCS607N</b>	<b>PW</b>	<b>Minor Project</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>60</b>	<b>40</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

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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.

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.

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- **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:

- Identify a task or problem relevant to /orIT
- 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
- 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.

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- 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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<b>BTIT608N</b>	<b>SEC</b>	<b>IT Workshop-SciLab/MATLAB</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>60</b>	<b>40</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

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### COURSE OBJECTIVES

The student will have ability to:

1. Familiarization of the syntax, semantics, data-types and library functions of numerical computing languages such as MATLAB and/or SCILAB.
2. Learn application of MATLAB and/or SCILAB for implementation/simulation and visualization of basic mathematical functions relevant to electronics applications.

### COURSE OUTCOMES

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

1. Understand the need for simulation/implementation for the verification of mathematical functions.
2. Understand the main features of the MATLAB/SciLab program development environment to enable their usage in the higher learning.
3. Implement simple mathematical functions/equations in numerical computing environments such as MATLAB/SciLab.
4. Interpret and visualize simple mathematical functions and operations thereon using plots/display.
5. Analyze the program for correctness and determine/estimate/predict the output and verify it under simulation environment using MATLAB/SCILAB tools.

### SYLLABUS

#### UNIT-I

**Introduction To Simulation Software:** About SciLab/MATLAB, SciLab/MATLAB System, Starting and Quitting SciLab/MATLAB.

**Expressions:** Variables Numbers, Operators Functions, Expressions.

#### UNIT-II

**Flow Control:** If, else, and else if, switch and case, for, while, continue, break try - catch, return.

**Command Window:** The format Function, Suppressing Output, Entering Long Statements, Command Line Editing.

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**UNIT–III**

**Matrices And Arrays:** Entering Matrices sum and transpose, subscripts, colon Operator, magic Function.

**Working With Matrices:** Generating Matrices, The load Function, M-Files, Concatenation, Deleting Rows and Columns, Linear Algebra, Arrays Multivariate Data, Scalar Expansion, Logical Subscripting, find Function.

**UNIT–IV**

**Scripts & Functions:** Scripts, Functions, Global Variables, Passing String Arguments to Functions, eval Function, Function Handles, Vectorization, Pre allocation.

**Other Data Structure:** Multidimensional Arrays, Cell Arrays, Characters and Text, Structures

**UNIT–V**

**Graphics:** Plotting Process, Editing Process, Preparing Graphs, Basic Plotting Functions, Mesh & Surface Plot, and Image Reading & Writing, Printing graphics. SIMULINK

**TEXT BOOKS & REFERENCES:**

1. MATLAB and its Applications in Engineering, Rajkumar Bansal, Pearson Publishers, ISBN-10: 8131716813, 2009.
2. A Guide to MATLAB: For Beginners & Experienced Users By: Kevin R. Coombes, John E. Osborn, Garrett J. Stuck
3. SCILAB(a Free Software to Matlab), Er. Hema Ramachandran and Dr. Achutsankar Nair, S. Chand Publishers, ISBN-10: 8121939704, 2011
4. Introduction to SCILAB by Rachna Verma and Arvind Verma
5. SCILAB—A Beginner’s Approach by Anil Kumar Verma
6. <http://in.mathworks.com/>
7. <https://www.scilab.org/resources/documentation/tutorials>

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BTIT608N	SEC	IT Workshop-SciLab/MATLAB	0	0	0	60	40	0	0	4	2

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

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**LIST OF PRACTICALS:**

- Addition, subtraction and multiplication of two matrices.
- Verify whether the given matrix is singular or non-singular and compute its inverse if applicable.
- Sorting of 1-D array and searching of an array/matrix. Also, list the set of numbers that obey a common condition in an array/matrix using *find()*.
- Solve simultaneous equations (maximum of three) using Cramer's rule. [Simultaneous equations may be obtained by applying KCL or KVL for a circuit and they can be solved for voltages or currents, respectively]
- a) Show that  $\log_{10}(A*B)=\log_{10} A + \log_{10} B$  and  $\log_{10}(A/B)=\log_{10} A - \log_{10} B$   
 b) Plot the voltage across capacitor during charging  $V_c = V_0[1 - e^{-(t/RC)}]$
- a) Plot a straight line for the given slope and intercept using different plot attributes.  
 b) Differentiate and integrate  $y = mx + c$ , separately, and display the results on the same plot.
- Plot  $y_1 = A \sin(2\pi f_1 t)$ ,  $y_2 = B \cos(2\pi f_2 t)$  and  $y_3 = A \sin(2\pi f_1 t) + B \cos(2\pi f_2 t)$ , in time and frequency (after computing DFT or FFT) domains as subplots and infer the results.
- Integrate and differentiate  $\sin(x)$  and display the results on the same plot in different colors. Also display  $\sin(x)$  on the same plot.
- Compute mean, median, standard deviation and variance of a set of data using formulae and verify using built-in functions.
- Find all the even and prime numbers between two numbers (range).
- Demonstrate (a) reading and display image, (b) converting color image to gray and black-and-white and plotting their histograms, and (c) conversion of image file formats.
- Compare the results of the built-in and user-defined function to compute  $\cos(x)$  [the series  $\cos(x) = 1 - (x^2/2!) + (x^4/4!) - (x^6/6!) + \dots$  can be used]
- Write a program to compute roots of a quadratic equation  $ax^2 + bx + c = 0$  given a, b and c.

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