Shri Vaishnav Vidyapeeth Vishwavidyalaya
Shri Vaishnav Institute of Information Technology
Choice Based Credit System (CBCS) in the light of NEP-2020
B.Tech. (CSE- Artificial Intelligence and Machine Learning - Microsoft)
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*				
BTCS601N	**DCC**	**Compiler Design**	**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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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. Dhamdhere, 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. HenkAlblas and Albert Nymeyer, “Practice and Principles of Compiler Building with C”, PHI, 2001
4. Kenneth C. Louden, “Compiler Construction: Principles and Practice”, Thompson Learning, 2003

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BTCS601N	**DCC**	**Compiler Design**	**60**	**20**	**20**	**30**	**20**	**2**	**1**	**2**	**4**

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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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BTAIML602N	DCC	Architecting Data Science Solution	60	20	20	30	20	3	-	2	4

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BTCS603N	DCC	Introduction to Cloud Computing	60	20	20	30	20	3	-	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 inan organization can becreated.
2. Assess the exploitation of web services from cloudcomputing.
3. Configure essential infrastructural components used for implementingCloud.
4. Significantly study case studies to derive the most excellent practice model to be appropriate when deploying cloud-basedapplications.

COURSE OUTCOMES
Upon completion of the course, students will be able to:
1. Investigate the trade-offs among deploying applications in the cloud and over the localinfrastructure.
2. Compute real-world problems security, privacy issues using cloud computing through group collaboration.
3. Development and Deployment applications over commercial cloud computinginfrastructures.
4. Analyze and investigation of application & hardware performance, scalability, and availability of the underlying cloud technologies andsoftware.

SYLLABUS

UNIT–I: **10 Hours**

Overview of Cloud Computing

Introduction- Evolution, Shift from distributed computing to cloud computing; principlesand characteristics of cloud computing- IaaS, PaaS, SaaS; service-orientedcomputing andcloudenvironment, Advantages, Service & Deployment Models, Infrastructure, and Consumer View, Functioning of Cloud Computing, Cloud Architecture, Cloud Storage, Cloud Services, Industrial Applications.

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UNIT–II: **8 Hours**

Cloud Computing Technology-

Client systems, Networks, server systems andsecurity from services perspectives, security and privacy issues; accessing the cloud with platforms and applications; Cloud storage

UNIT–III: **9 Hours**

Working with Cloud

Infrastructure as a Service – conceptual model and working, Platform as a Service – conceptual model and functionalities. Software as a Service –conceptual model and working.Trendsin Service provisioning with clouds.Working on Microsoft Azure & IBM SmartCloud.

UNIT–IV:

Using Cloud Services **9 Hours**

Cloud collaborative applications and services – case studieswith calendars, schedulers, and event management; cloud applications in project management. Amazon Web Services & applications, AWS EC2, S3, Cloud Analytics, Cloud Open Stack

UNIT–V: **8 Hours**

Case studies- Microsoft Azure, Google App Engine, IBM Smart Cloud and Open source clouds,- Open-Nebula, Sales force and Eucalyptus, Cloud Simulation

TEXT BOOKS:

1. Cloud Computing: A Practical Approach by Anthony T. Velte Toby J. Velte,RobertElsenpeter, 2010 by TheMcGraw-Hill.
2. Buyya, Selvi ,Mastering Cloud Computing,TMHPub.
3. Michael Miller, Cloud computing – Web based Applications, Pearson Publishing,2011

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REFERENCES:

1. Kumar Saurabh, “Cloud Computing”, WileyPub,2012.
2. Krutz , Vines, “Cloud Security , WileyPub,2013.
3. Sosinsky, “Cloud Computing”, WileyPub,2012.
4. Murray Woodside; John Chinneck; Marin Litiou on “Adaptive Cloud Deployment UsingPersistence Strategies and Application Awareness”IEEEXplore, Year: 2017, Page(s):277 – 290.

LIST OF PRACTICALS:

1. Service deployment & Usage over cloud using VirtualBox.
2. Performance evaluation of services over cloud using VMwaretool.
3. Working of Goggle Drive to makespreadsheet.
4. Working on Herokufor Cloud applicationdeployment.
5. Working on Anekasevices for Cloudapplication.
6. Working on services of Google AppEngine.
7. Working on Application deployment & services of MicrosoftAzure.
8. Working on Application deployment & services of IBM SmartCloud.
9. Working and configuration ofEuceliptus.
10. Deployment &Services of Amazon WebServices.

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BTDSE611N	DSE	Block Chain	60	20	20	30	20	3	0	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 andEthereum 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 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 **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:

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 chainTechnology and Leveraging Block Chain Programming”.
3. Daniel Drescher, “Block Chain Basics”, Apress; 1stedition, 2017.
4. Anshul Kaushik, “Block Chain and Crypto Currencies”, Khanna Publishing House, Delhi.
5. Imran Bashir, “Mastering Block Chain: Distributed Ledger Technology, Decentralizationand Smart Contracts Explained”, Packt Publishing.

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6. Ritesh Modi, "Solidity Programming Essentials: A Beginner's Guide to Build SmartContracts 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

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/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 queryon 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 chainnetwork 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 aHyperledger Fabric network.
   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/
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 resultsand data in the starter plan.
   https://developer.ibm.com/patterns/car-auction-network-hyperledger-fabric-node-sdk-starter-plan/

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BTDSE611N	**DSE**	**Block Chain**	**60**	**20**	**20**	**30**	**20**	**3**	**0**	**2**	**4**

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7. Develop an IoT asset tracking app using Block chain. Use an IoT asset tracking device toimprove 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 helpdemocratize 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 howcommunication 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 datasent 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 enabledhealth and fitness app with Android and Kubernetes.
   https://developer.ibm.com/patterns/create-an-android-app-with-block chain-integration/
   (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 GlobalFinance with block chain usecase
   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'shosting 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 asmart contract through a Node.js web app
   https://developer.ibm.com/patterns/loyalty-points-fabric-evm/

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BTDSE612N	DSE	**Robotics**	**60**	**20**	**20**	**30**	**20**	**3**	**-**	**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 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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BTDSE612N	DSE	**Robotics**	**60**	**20**	**20**	**30**	**20**	**3**	**-**	**2**	**4**

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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, 2nd Edition, McGraw-Hill Higher Education, NewDelhi, 2014.
2. Ghosal, A., "Robotics", Oxford, New Delhi, 2006.
3. Niku Saeed B., "Introduction to Robotics: Analysis, Systems, Applications", PHI, NewDelhi.
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, "IntelligentMechatronic 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.
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. Projectwork.

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			THEORY			PRACTICAL					
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BTDSE613N	DSE	**Data Mining and Visualization**	**60**	**20**	**20**	**30**	**20**	**3**	**-**	**2**	**4**

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BTIT608N	**DCC**	**IT Workshop - SciLab/MATLAB**	**-**	**-**	**-**	**30**	**20**	**0**	**0**	**2**	**1**

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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 mathematicalfunctions.
2. Understand the main features of the MATLAB/SciLab program developmentenvironment to enable their usage in the higher learning.
3. Implement simple mathematical functions/equations in numerical computing environmentsuch as MATLAB/SciLab.
4. Interpret and visualize simple mathematical functions and operations thereon usingplots/display.
5. Analyze the program for correctness and determine/estimate/predict the output and verifyit under simulation environment using MATLAB/SCILAB tools.

SYLLABUS

UNIT–I
Introduction To Simulation Software: AboutSciLab/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, SuppressingOutput, Entering Long Statements,Command Line Editing.

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BTIT608N	**DCC**	**IT Workshop - SciLab/MATLAB**	**-**	**-**	**-**	**30**	**20**	**0**	**0**	**2**	**1**

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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, RajkumarBansal, 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. HemaRamachandran and Dr. Achutsankar Nair, S. Chand Publishers, ISBN-10: 8121939704,2011
4. Introduction to SCILAB by RachnaVerma and ArvindVerma
5. SCILAB—A Beginner's Approach by Anil Kumar Verma
6. http://in.mathworks.com/
7. https://www.scilab.org/resources/documentation/tutorials

LIST OF PRACTICALS:

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BTIT608N	**DCC**	**IT Workshop - SciLab/MATLAB**	**-**	**-**	**-**	**30**	**20**	**0**	**0**	**2**	**1**

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

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BTCS607N	PW	Minor Project	0	0	0	60	40	0	0	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 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.

Objectives/Learning Outcomes/Capability

Development Program Learning 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 Information Technology.

- **Critical Analysis:**

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

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BTCS607N	**PW**	**Minor Project**	**0**	**0**	**0**	**60**	**40**	**0**	**0**	**4**	**2**

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- analyze and model complex requirements and constraints for the purpose of designing and implementing software artifacts and ITsystems

- 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.

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BTCS607N	**PW**	**Minor Project**	**0**	**0**	**0**	**60**	**40**	**0**	**0**	**4**	**2**

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- **Research andScholarship:**

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 relevantliterature
- Propose a solution to the task orproblem
- Develop a software and/or algorithmic solution to the task orproblem
- Implement solutions to meet high quality requirements developed by thesupervisor
- Carry out research undersupervision
- Present the research in a written form like that used for publishedpapers
- Present the research in an oralseminar.

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BTCS607N	**PW**	**Minor Project**	**0**	**0**	**0**	**60**	**40**	**0**	**0**	**4**	**2**

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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 oralseminar.

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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