## SEMESTER VI

| COURSE CODE | CATEGORY | COURSE NAME | L | T | P | CREDITS | THEORY | | | PRACTICAL | |
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| | | | | | | | END SEM University Exam | Two Term Exam | Teachers Assessment* | END SEM University Exam | Teachers Assessment* |
| BTCS501 | - | Theory Of Computation | 3 | 1 | - | 4 | 60 | 20 | 20 | - | - |

**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.

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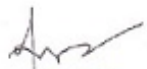
## TEXT BOOKS:
1. Hopcroft and Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education, 3rd edition, 2014
2. Peter Linz, "An Introduction to Formal Language and Automata", NarosaPub.House, 2011.
3. K.L.P Mishra & N.Chandrasekaran,"Theory of Computer Science", PHI Learning,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

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

| COURSE CODE | CATEGORY | COURSE NAME | L | T | P | CREDITS | TEACHING & EVALUATION SCHEME | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | THEORY | | | PRACTICAL | |
| | | | | | | | END SEM University Exam | Two Term Exam | Teachers Assessment* | END SEM University Exam | Teachers Assessment* |
| BTCS602 | - | **Internet Of Things** | 3 | 0 | 2 | 4 | 60 | 20 | 20 | 30 | 20 |

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

## COURSE OUTCOMES
Upon completion of the subject, students will be able to:
1. Understand internet of Things and its hardware and software components
2. Interface I/O devices, sensors & communication modules
3. Remotely monitor data and control devices
4. Develop real life IoT based projects

## SYLLABUS:

### UNIT–I
**Introduction to IoT:**Architectural Overview, Design principles and needed capabilities, IoT Applications, Sensing,Actuation, Basics of Networking, M2M and IoT Technology Fundamentals- Devices andgateways, Data management, Business processes in IoT, Everything as a Service(XaaS), Role ofCloud in IoT, Security aspects in IoT.

### UNIT–II
**Elements of IoT:**Hardware Components- Computing (Arduino, Raspberry Pi), Communication, Sensing,Actuation, I/O interfaces.
Software Components- Programming API's (using Python/Node.js/Arduino) for Communication
Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP.

### UNIT–III
**IoT Application Development:**Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration.

### UNIT–IV
**Device data storage:** Unstructured data storage on cloud/local server,Authentication, authorization of devices.

### UNIT–V
**IoT Case Studies:**IoT case studies and mini projects based on Industrial automation, Transportation, Agriculture,Healthcare, Home Automation
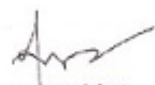
## TEXT BOOKS:

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

## LIST OF PRACTICALS:
1. Familiarization with Arduino/Raspberry Pi and perform necessary software installation.
2. To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LEDfor 1 sec after every 2 seconds.
3. To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write aprogram to turn ON LED when push button is pressed or at sensor detection.
4. To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to printtemperature and humidity readings.
5. To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ONmotor when push button is pressed.
6. To interface OLED with Arduino/Raspberry Pi and write a program to print temperature andhumidity readings on it.
7. To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor datato smartphone using Bluetooth.
8. To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFFwhen '1'/'0' is received from smartphone using Bluetooth.
9. Write a program on Arduino/Raspberry Pi to upload temperature and humidity data tothingspeak cloud.
10. Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data fromthingspeak cloud.
11. To install MySQL database on Raspberry Pi and perform basic SQL queries.
12. Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.
13. Write a program on Arduino/Raspberry Pi to subscribe to MQTT broker for temperature dataand print it.
14. Write a program to create TCP server on Arduino/Raspberry Pi and respond with humiditydata to TCP client when requested.
15. Write a program to create UDP server on Arduino/Raspberry Pi and respond with humiditydata to UDP client when requested.

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| BTCS701 | - | **Cloud Computing** | 3 | 0 | 2 | 4 | 60 | 20 | 20 | 30 | 20 |

**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. Analyze the SAAS, PAAS IAAS services of Cloud Computing to represent how engineering agility inan organization can be created.
2. Assess the exploitation of web services from cloud computing.
3. Configure essential infrastructural components used for implementing Cloud.
4. Significantly study case studies to derive the most excellent practice model to be appropriate when deploying cloud based applications.

## 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. Analyze and investigation of application & hardware performance, scalability, and availability of the underlying cloud technologies and software.

## SYLLABUS

### UNIT–I: Overview of Cloud Computing
Introduction- Evolution, Shift from distributed computing to cloud computing; principles and characteristics of cloud computing- IaaS, PaaS, SaaS; service oriented computing and cloud environment, Advantages, Service & Deployment Models, Infrastructure, and Consumer View, Functioning of Cloud Computing, Cloud Architecture, Cloud Storage, Cloud Services, Industrial Applications.

### UNIT–II :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: 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.Trends in Service provisioning with clouds.Working on Microsoft Azure & IBM Smart Cloud.
### UNIT–IV: Using Cloud Services-

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: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 The McGraw-Hill.
2. Buyya, Selvi ,” Mastering Cloud Computing “,TMH Pub.
3. Michael Miller, Cloud computing – Web based Applications, Pearson Publishing, 2011
**REFERENCES:**
1. Kumar Saurabh, "Cloud Computing", Wiley Pub,2012.
2. Krutz , Vines, "Cloud Security , Wiley Pub,2013.
3. Sosinsky, " Cloud Computing", Wiley Pub,2012.
4. Murray Woodside; John Chinneck ; Marin Litiou on "Adaptive Cloud Deployment Using Persistence Strategies and Application Awareness"IEEEXplore, Year: 2017, Page(s):277 – 290.

**LIST OF EXPERIMENTS:**
1. Service deployment & Usage over cloud using Virtual Box.
2. Performance evaluation of services over cloud using VMware tool.
3. Working of Goggle Drive to make spreadsheet.
4. Working on Herokufor Cloud application deployment.
5. Working on Anekasevices for Cloud application.
6. Working on services of Google App Engine.
7. Working on Application deployment & services of Microsoft Azure.
8. Working on Application deployment & services of IBM Smart Cloud.
9. Working and configuration of Euceliptus.
10. Deployment &Services of Amazon Web Services.

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| | | | | | | | END SEM University Exam | Two Term Exam | Teachers Assessment* | END SEM University Exam | Teachers Assessment* |
| BTCS608 | - | **Data Science** | 3 | 0 | 2 | 4 | 60 | 20 | 20 | 30 | 20 |

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

**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: Usingthe Twitter APIs),Cleaning and Munging, Manipulating Data, Rescaling,Dimensionality Reduction.

**UNIT–III**
**Mathematical Foundations:**Linear Algebra: Vectors, Matrices,Statistics: Describing a Single Set ofData, Correlation, Simpson's Paradox,Correlation and Causation, Probability: Dependence andIndependence, Conditional Probability, Bayes'sTheorem, Random Variables, ContinuousDistributions, 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, Typesof Machinelearning – Supervised, Unsupervised, Reinforced learning, Introduction to Bayes Theorem,LinearRegression- model assumptions, regularization (lasso, ridge, elastic net), Classification andRegression algorithms- Naïve Bayes, K-Nearest Neighbors, logistic regression,

support vectormachines (SVM), decision trees, and random forest, Classification Errors, Analysis of TimeSeries- 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.
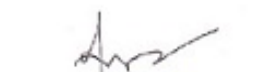
### TEXT BOOKS:

1. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media.
2. AurélienGéron, "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, YoshuaBengio and Aaron Courville, "Deep Learning", MIT Press
   http://www.deeplearningbook.org
8. Jiawei Han and Jian Pei, "Data Mining Concepts and Techniques", Third Edition, MorganKaufmann Publishers

### LIST OF PRACTICALS:

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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| COURSE CODE | CATEGORY | COURSE NAME | L | T | P | CREDITS | TEACHING & EVALUATION SCHEME | | | | |
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| | | | | | | | THEORY | | | PRACTICAL | |
| | | | | | | | END SEM University Exam | Two Term Exam | Teachers Assessment* | END SEM University Exam | Teachers Assessment* |
| BTCS612 | | **Simulation and Modeling** | 2 | 1 | 2 | 4 | 60 | 20 | 20 | 30 | 20 |

**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&industrialreal 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
Introduction to simulation & modeling, advantages anddisadvantages of simulation, application areas in communication, computer and softwaredesign, systems and systems environment, components of a system, discrete and continuoussystems, model of a system, types of models, discrete-event simulation, steps in a simulationstudy. Simulation Examples- Simulation of queueing systems, on-demand and inventorysystems, 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, equilibriumof 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.
2.Law AM and Kelton WD; Simulation Modeling and Analysis; TMH

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

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9. Study of SIMULA.
10.Study of DYNAMO.

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

**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. 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.

## 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 Careeer 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.
3. Waman S.Jawadekar,"Software Enginerring", TMH
4. Sommerville,"Software Enginerring",Pearson Education.
5. http://www.softwaretestinghelp.com/online-software-testing-course-syllabus/
6.https://amizone.net/AdminAmizone/WebForms/Academics/NewSyllabus/1217201473127725

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Incore

pdf
7. http://www.tutorialspoint.com/uml/

**LIST OF EXPERIMENTS: (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 University Exam | Two Term Exam | Teachers Assessment* | END SEM University Exam | Teachers Assessment* |
| BTCS618 | - | **Block Chain** | 2 | 1 | 2 | 4 | 60 | 20 | 20 | 30 | 20 |

**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 technologycan be used to innovate and improve business processes.
2. Covers the technological underpinning of block Chain operations in both theoretical and practical implementation ofsolutions 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
**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 ofBlock chain.
Basic Crypto Primitives: Cryptographic Hash Function, Properties of a hash function, Hash pointerand Merkle tree, Digital Signature, Public Key Cryptography, A basic cryptocurrency.

### UNIT–II
**Understanding Block chain with Crypto currency:**Bitcoin and Block chain: Creation of coins, Payments and double spending, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay.
Working with Consensus in Bitcoin**:** Distributed consensus in open environments, Consensus in a Bitcoin network, Proof of Work (PoW) – basic introduction, HashcashPoW, BitcoinPoW, 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 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
**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
**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. AnshulKaushik, "Block Chain and Crypto Currencies", Khanna Publishing House, Delhi.
5. Imran Bashir, "Mastering Block Chain: Distributed Ledger Technology, Decentralizationand Smart Contracts Explained", Packt Publishing.
6. RiteshModi, "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 to run.
   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 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/

(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/

(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-evm/

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| COURSE CODE | CATEGORY | COURSE NAME | L | T | P | CREDITS | TEACHING & EVALUATION SCHEME | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | THEORY | | | PRACTICAL | |
| | | | | | | | END SEM University Exam | Two Term Exam | Teachers Assessment* | END SEM University Exam | Teachers Assessment* |
| BTCS617 | - | **Robotics** | 2 | 1 | 2 | 4 | 60 | 20 | 20 | 30 | 20 |

**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 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 andopen-loopcontrol systems.
Kinematics systems; Definition of mechanisms and manipulators, Social issues andsafety.

**UNIT–II**
**Robot Kinematics and Dynamics:**Kinematic Modelling: Translation and Rotation
Representation,Coordinatetransformation, 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.
Introductionto Cameras, Camera calibration, Geometry of Image formation,Euclidean/Similarity/Affine/Projective transformations.Vision applications in robotics.

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

**UNIT–V**
**Robot Actuation Systems:**Actuators: Electric, Hydraulic and Pneumatic; Transmission: Gears, Timing Belts and Bearings, Parameters for selection of actuators.
**Control Hardware and Interfacing:**Embedded systems: Architecture and integration with sensors, actuators, components, Programming for Robot Applications.

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## TEXT BOOKS:

1. Saha, S.K., "Introduction to Robotics, 2nd Edition, McGraw-Hill Higher Education, NewDelhi, 2014.
2. Ghosal, A., "Robotics", Oxford, New Delhi, 2006.
3. NikuSaeed 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 (RoboAnalyser 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 controllersand ROS (Robot Operating System) in a robotic system.
10. Project work

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| COURSE CODE | CATEGORY | COURSE NAME | L | T | P | CREDITS | TEACHING & EVALUATION SCHEME | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | THEORY | | | PRACTICAL | |
| | | | | | | | END SEM University Exam | Two Term Exam | Teachers Assessment* | END SEM University Exam | Teachers Assessment* |
| BTIT608 | - | IT Workshop-SciLab/Matlab | 0 | 0 | 4 | 2 | 0 | 0 | 0 | 60 | 40 |

**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. 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.

**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:
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 $cos(x)=1-(x^2/2!)+ (x^4/4!)- (x^6/6!)+ ...$ can be used]
13. Write a program to compute roots of a quadratic equation $ax^2+bx+c=0$ given a, b and c.

| COURSE CODE | CATEGORY | COURSE NAME | L | T | P | CREDITS | TEACHING & EVALUATION SCHEME | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | THEORY | | | PRACTICAL | |
| | | | | | | | END SEM University Exam | Two Term Exam | Teachers Assessment* | END SEM University Exam | Teachers Assessment* |
| BTCS606 | - | **Minor Project** | - | - | 4 | 2 | - | - | - | 60 | 40 |

**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 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:

- **Enabling Knowledge:**

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

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

- **Critical Analysis:**

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

➤ analyze and model complex requirements and constraints for the purpose of designing and implementing software artifacts and IT systems

➢ Evaluate and compare designs of software artifacts and IT systems on the basis of organizational and user requirements.

- **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:

- 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.