# Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur

**(An Autonomous Institution Affiliated to RTM Nagpur University, Nagpur)**

**SCHEME OF INSTRUCTION & SYLLABI**

**Programme: Computer Science and Engineering**

**Scheme of Instructions: Third Year B.Tech. in Computer Science and Engineering**

**Semester–VI**

| Sr. No. | Course Category | Course Code | Course Title | L | T | P | Contact Hrs/Wk | Credits | Exam Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | CT-1 | CT-2 | CA | ESE | TOTAL |
| 1 | **PCC** | BCS33601 | Compiler Design | 3 | - | - | 3 | 3 | 15 | 15 | 10 | 60 | 100 |
| 2 | **PCC** | BCS33602 | Data Science and Analytics | 3 | - | - | 3 | 3 | 15 | 15 | 10 | 60 | 100 |
| 3 | **VSEC** | BCS33603 | Software Laboratory - II (Software Testing Manual/ Automation) | - | - | 4 | 4 | 2 | - | - | 50 | 50 | 100 |
| 4 | **PEC** | BCS33604-07 | Program Elective–II | 4 | - | - | 4 | 4 | 15 | 15 | 10 | 60 | 100 |
| 5 | **PEC** | BCS33608-11 | Program Elective–III | 4 | - | - | 4 | 4 | 15 | 15 | 10 | 60 | 100 |
| 6 | **MDM** | BEC33613 | Embedded System | 2 | - | - | 2 | 2 | 7 | 7 | 6 | 30 | 50 |
| 7 | **PCC** | BCS33612 | Compiler Design Lab | - | - | 2 | 2 | 1 | - | - | 25 | 25 | 50 |
| 8 | **PCC** | BCS336013 | Data Science and Analytics Lab | - | - | 2 | 2 | 1 | - | - | 25 | 25 | 50 |
| | | | **Total** | **16** | | **8** | **24** | **20** | **67** | **67** | **145** | **370** | **650** |

L-Lecture SL-Self Learning P-Practical NHL-Notional Hrs/Wk (Total Notional Hrs)

CT1-ClassTest1 TA/CA-Teacher Assessment/Continuous Assessment

CT2-ClassTest2 ESE-End Semester Examination (For Laboratory End Semester Performance)

| Course Category | BSC/ESC (Basic Science Course/Engineering Science Course.) | PCC (Programme Core courses) | PEC (Programme Elective courses) | OEC (Open Elective Course) | Multi-disciplinary courses | VSEC (Skill Course) | VEC (Value Education Courses) | Humanities Social Science & Management | | Experiential Learning Courses | CC (Liberal Learning Courses) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | AEC (Ability Enhancement Course) | IKS (Indian Knowledge System) | | |
| Credits | | 8 | 8 | - | 2 | 2 | - | - | | - | |
| Cumulative Sum | 16/13 | 40 | 12 | 8 | 10 | 8 | 4 | 10 | | 2 | 4 |

PROGRESSIVE TOTAL CREDITS: 107+20=127

| Chairman | Dean Academics | Vice Principal | Principal | Date of Release | Version | |
|---|---|---|---|---|---|---|
| HOD Dept. of Computer Science & Engineering Tulsiramji Gaikwad Patil College of Engineering & Technology | Dean Academics Tulsiramji Gaikwad-Patil College Of Engineering and Technology, Nagpur | Vice Principal Tulsiramji Gaikwad-Patil College Of Engineering & Technology, Nagpur | Dr. Premanand Naktode Principal TGPCET, Nagpur | Apr. , 2025 | 1.00 | Applicable for AY 2025-26 Onwards |

# Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur

SCHEME OF INSTRUCTION& SYLLABI

Program: Computer Science & Engineering

**List of Electives offered by**

**Computer Science & Engineering**

| **Course Code** | **Professional Elective- I** |
|---|---|
| | **Semester V** |
| BCS33504 | Artificial Intelligence |
| BCS33505 | Principles of Distributed Systems |
| BCS33506 | Design Patterns |
| BCS33507 | Introduction to Data Science |

| **Course Code** | **Professional Elective- II** | **Course Code** | **Professional Elective- III** |
|---|---|---|---|
| | **Semester VI** | | **Semester VI** |
| BCS33604 | Neural Network and Fuzzy Logic | BCS33608 | TCP/IP |
| BCS33605 | Cloud Computing | BCS33609 | Computer Graphics |
| BCS33606 | Software Project Management | BCS33610 | Network Security |
| BCS33607 | Data Visualization Techniques | BCS33611 | Blockchain and Distributed Ledger Technology |

**Tulsiramji Gaikwad-Patil College of Engineering and Technology**

WardhaRoad,Nagpur-441108

**NAAC Accredited (A+ Grade)**

**An Autonomous Institute affiliated to RTMNU Nagpur**

**Third Year (Semester-VI ) B.Tech. (CSE)**

**Course Code : BCS33601 (Compiler Design)**

| Teaching Scheme | |
|---|---|
| **Lectures** | 3Hrs/week |
| **Tutorial** | - |
| **Total Credit** | 3 |

| Examination Scheme | |
|---|---|
| **CT-1** | 15 Marks |
| **CT-2** | 15 Marks |
| **CA** | 10 Marks |
| **ESE** | 60 Marks |
| **Total** | 100 Marks |

Duration Of ESE:03 Hrs 00Min.

**Course Objective:**

| | |
|---|---|
| 1 | Understand phases of compiler , Generate scanner for simple tokens using lex. |
| 2 | Design parser for simple CFG , Generate parser using Bison/YACC. |
| 3 | Generate intermediate code for basic programming constructs. |
| 4 | Perform optimization on intermediate code for space and time. |
| 5 | Generate machine code for small segments of Three address code and Symbol Table |

**Course Contents**

| | |
|---|---|
| **Unit I** | **Introduction to Compiler**<br>Structure of a Compiler, Lexical Analysis, Role of Lexical Analyzer , Input Buffering, Specification of Tokens , Recognition of Tokens , Design of a Lexical Analyzer Generator, LEX. |
| **Unit II** | **Syntax Analysis**<br>The role of the Parser, Context-free grammars, Writing a Grammar, Top-Down Parsing, Bottom-Up Parsing, Operator-precedence Parsing, LR Parsers, Using Ambiguous Grammars , Parser Generators. |
| **Unit III** | **Semantic Analysis**<br>Definitions - Syntax directed definitions , Construction of Syntax Trees , Bottom-Up Evaluation of, S-attributed definition, L-attribute definition, Top-Down Translation, Intermediate Languages, Declarations, Assignment Statements, Boolean Expressions ,Case Statements, Back patching, Procedure Calls. |
| **Unit IV** | **Code optimization**<br>Sources of optimization, loop optimization, control flow analysis, data flow analysis, Live variables , Induction Variable, Common subexpression elimination, dead code elimination Introduction to global data flow analysis, Code Improving transformations ,Data flow analysis of structure flow graph Symbolic debugging of optimized code. |
| **Unit V** | **Code Generation**<br>Issues in the Design of a Code Generator, The Target Language, Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Register allocation and Assignment, The DAG Representation of Basic Blocks, Generating Code from DAG. |

**Text Books**

| | |
|---|---|
| 1 | Compilers–Principles,TechniquesandTools;Aho,Sethi,andUllman;SecondEdition, Pearson Education, 2008 |
| 2 | Principles of Compiler Design; Alfred V. Ahoand Jeffery D.Ullman; Narosa Publishing House, 1977 |
| **Reference Books** | |
| 1 | Principles of Compiler Design ,V. Raghavan, TataMcGrawHill, 2009. |
| 2 | Compiler Design using Flex and Yacc; Vinu V.Das; PHI Publication, 2008. |
| **Useful Links** | |
| 1 | https://archive.nptel.ac.in/courses/106/104/106104148/ |
| 2 | http://www.digimat.in/nptel/courses/video/106104148/L01.html |
| 3 | https://www.geeksforgeeks.org/last-minute-notes-compiler-design-gq/ |
| 4 | https://www.tutorialspoint.com/compiler_design/compiler_design_quick_guide.htm |

| | Course Outcomes | CL | Class Session |
|---|---|---|---|
| **1** | **Understand** the major phases of compilers and **use** the knowledge of the Lex tool | 2 | 9 |
| **2** | **Develop** the parsers and **experiment with** the knowledge of different parsers design without automated tools. | 3 | 9 |
| **3** | **Construct** intermediate code for basic programming constructs in C/PASCAL | 6 | 9 |
| **4** | **Analyze** TAC for space and time | 6 | 9 |
| **5** | **Develop** machine code for small segments of TAC and Symbol Table | 2,3 | 9 |

HOD
Dept. of Computer Science & Engineering
Tulsiramji Gaikwad Patil College of Engineering & Technology

Dean Academics
Tulsiramji Gaikwad-Patil
College Of Engineering
and Technology, Nagpur

**Tulsiramji Gaikwad-Patil College of Engineering and Technology**
Wardha Road, Nagpur-441108
**NAAC Accredited (A+ Grade)**
**An Autonomous Institute affiliated to RTMNU Nagpur**

## Third Year (Semester-VI) B.Tech. (CSE)

## Course Code: BCS33602 (Data Science and Analytics)

| Teaching Scheme | |
|---|---|
| **Lectures** | 3 Hrs/week |
| **Tutorial** | - |
| **Total Credit** | 3 |

| Examination Scheme | |
|---|---|
| **CT-1** | 15 Marks |
| **CT-2** | 15 Marks |
| **TA** | 10 Marks |
| **ESE** | 60 Marks |
| **Total** | 100 Marks |
| Duration of ESE :03 Hrs 00Min. | |

**Course Objective:**

| | |
|---|---|
| 1 | To understand the fundamentals of Basics of Data Science, its evolution and real-world applications. |
| 2 | To Summarize techniques for data collection and pre-processing to ensure data quality. |
| 3 | To Develop the ability to explore and summarize datasets using statistical techniques and visualization tools for better decision-making. |
| 4 | To Analyze machine learning model development techniques and enable them to build and optimize predictive models. |
| 5 | To Demonstrate to assess model performance, fine-tune parameters, and deploy models for real-world applications while ensuring robustness and reliability. |

**Course Contents**

| | |
|---|---|
| **Unit I** | **Introduction to Data Science**<br>Evolution of Data Science, Data Science Roles, Stages in a Data Science Project, Applications of Data Science in various fields, Data Security Issues, Big data and cloud computing in Data Science. |
| **Unit II** | **Data Collection and Data Pre-Processing**<br>Data Collection Overview, Data Collection Strategies, Data Pre-Processing Overview, Data Cleaning, Data Integration and Data Transformation, Data Reduction, Data Discretization, Data Quality Issue, Handling Missing Data and Outliers, Feature Scaling and Normalization. |
| **Unit III** | **Exploratory Data Analytics**<br>Introduction to Exploratory Data Analytics, Descriptive Statistics, Mean, Standard Deviation, Skewness and Kurtosis, Box Plots, Pivot Table, Heat Map, Correlation Statistics, ANOVA. Model Development, Probability Distributions, Hypothesis Testing. |
| **Unit IV** | **Model Development**<br>Simple and Multiple Regression, Model Evaluation using Visualization, Residual Plot, Distribution Plot, Polynomial Regression and Pipelines, Feature Engineering, Introduction to Machine Learning Models (Supervised vs. Unsupervised Learning), Logistic Regression and Linear Regression classification Models, Decision Trees and Random Forest, Support Vector Machines (SVM), Neural Networks (Basic Concepts). |

| | |
|---|---|
| **Unit V** | **Model Evaluation**<br>Generalization Error, Out-of-Sample Evaluation Metrics, Cross Validation, Overfitting, Underfitting and Model Selection, Prediction by using Ridge Regression, Testing Multiple Parameters by using Grid Search make another syllabus add some more important topics, Hyperparameter Tuning, Bias-Variance Tradeoff, Model Deployment and Monitoring |
| **Text Books** | |
| T.1 | Cathy O'Neil and Rachel Schutt, "Doing Data Science", O'Reilly, 2015 |
| T.2 | David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", EMC 2013 |
| T.3 | JojoMoolayil, "Smarter Decisions: The Intersection of loT and Data Science", PACKT, 2016. |
| **Reference Books** | |
| 1 | "Essential Math for Data Science", Thomas Nield |
| 2 | "A Hands on Introduction to Data Science", Chirag Shah,Cambridge University Press |
| **Useful Links** | |
| 1 | https://www.datacamp.com/ |
| 2 | https://www.coursera.org |

| Code | Course Outcomes | CL | Class Session |
|---|---|---|---|
| **BCS33602.1** | **Understand** the knowledge of basic concepts of data science and key issues | 2 | 9 |
| **BCS33602.2** | **Apply** data collection and data pre-processing techniques in data science. | 3 | 9 |
| **BCS33602.3** | **Analyze** fundamentals of Exploratory Data Analytics. | 4 | 9 |
| **BCS33602.4** | **Implement** regression models using appropriate software tools. | 3 | 9 |
| **BCS33602.5** | **Apply** appropriate evaluation metrics based on the problem domain and goals. | 3 | 9 |

HOD
Dept. of Computer Science & Engineering
Tulsiramji Gaikwad Patil College of Engineering & Technology

Dean Academics
Tulsiramji Gaikwad-Patil College Of Engineering and Technology, Nagpur

**Tulsiramji Gaikwad-Patil College of Engineering and Technology**

Wardha Road, Nagpur- 441108

**NAAC Accredited (A+ Grade)**

**An Autonomous Institute affiliated to RTMNU Nagpur**

## Third Year (Semester-VI) B.Tech. (CSE)

## Course Code:BCS33604(Neural Network and Fuzzy Logic)

| Teaching Scheme | |
|---|---|
| **Lectures** | 4 Hrs/week |
| **Tutorial** | - |
| **Total Credit** | 4 |

| Examination Scheme | |
|---|---|
| **CT-1** | 15 Marks |
| **CT-2** | 15 Marks |
| **CA** | 10 Marks |
| **ESE** | 60 Marks |
| **Total** | 100 Marks |
| Duration of ESE: 03Hrs 00Min. | |

**Course Objective:**

| | |
|---|---|
| 1 | **To understand** the basics of Neural Networks. |
| 2 | **To analyze** fundamental concepts of Artificial Neural Networks. |
| 3 | **To identify** the concepts of Competitive and Special Neural Networks |
| 4 | **To apply** set operations and membership functions for problems involving both precise and imprecise information. |
| 5 | **To demonstrate** comprehensive understanding of fuzzy logic system components. |

### Course Contents

| | |
|---|---|
| **Unit I** | **Introduction to Neural Networks**<br>Introduction, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, The Perceptron, Backpropagation Network, Hodgkin-Huxley Neuron Model, Integrate-and-Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCulloch-Pitts Model, Applications of ANN. |
| **Unit II** | **Essentials of Artificial Neural Networks**<br>Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application |
| **Unit III** | **Competitive and Special Neural Networks**<br>Neural network based on competition: fixed weight competitive nets, Kohonen self -organizing maps and applications, learning vector quantization, counter propagation nets and applications.<br>Special Neural Network: Cognitron and Neocognitron Architecture, training algorithm and application-fuzzy associate memories, fuzzy system architecture, comparison of fuzzy and neural systems. |
| **Unit IV** | **Classical & Fuzzy Sets**<br>Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions. |
| **Unit V** | **Fuzzy Logic System Components**<br>Fuzzification, Membership value assignment: Inference, rank ordering, angular fuzzy sets development of rule base and decision-making system, Defuzzification to crisp sets, Defuzzification methods, Fuzzy measures, Fuzzy integrals, Fuzziness and fuzzy resolution. |

| Text Books | |
|---|---|
| T1 | Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by Rajasekharan and Rai – PHI Publication |
| T2 | Introduction to Neural Networks using MATLAB 6.0 - S.N.Sivanandam, S.Sumathi, S.N.Deepa, TMH, 2006 |
| **Reference Books** | |
| R1 | Neural Networks – James A Freeman and Davis Skapura, Pearson Education, 2002. |
| R2 | Neural Networks and Fuzzy Logic System by Bart Kosko, PHI Publications. |
| **Useful Links** | |
| 1 | **Fuzzy Logic and Neural Networks - Course (nptel.ac.in)** |
| 2 | **NOC \| Fuzzy Logic and Neural Networks (nptel.ac.in)** |

| Sr. No. | Course Outcomes | CL | Class Session |
|---|---|---|---|
| **1** | **Explain** the basics of neural networks. | 2 | 9 |
| **2** | **Illustrate** fundamental concepts of ANN including operations, activation functions, learning rule. | 2 | 9 |
| **3** | **Apply** competitive and special neural networks (Kohonen, LVQ, Counter propagation, Cognitron, Neocognitron, Fuzzy AM) for problem-solving. | 3 | 9 |
| **4** | **Analyze** the principles of classical and fuzzy sets, including their properties, operations, relations, uncertainty, and membership functions. | 4 | 9 |
| **5** | **Apply** fuzzification, Membership value assignment, Defuzzification. | 3 | 9 |

HOD
Dept. of Computer Science & Engineering
Tulsiramji Gaikwad Patil College of Engineering & Technology

Dean Academics
Tulsiramji Gaikwad-Patil College Of Engineering and Technology, Nagpur

**Tulsiramji Gaikwad-Patil College of Engineering and Technology**

Wardha Road, Nagpur- 441108

**NAAC Accredited (A+ Grade)**

**An Autonomous Institute affiliated to RTMNU Nagpur**

## Third Year (Semester-VI) B. Tech. (CSE)

## Course Code: BCS33605 (Cloud Computing)

| Teaching Scheme | |
|---|---|
| **Lectures** | 4 Hrs/week |
| **Tutorial** | - |
| **Total Credit** | 4 |

| Examination Scheme | |
|---|---|
| **CT-1** | 15 Marks |
| **CT-2** | 15 Marks |
| **CA** | 10 Marks |
| **ESE** | 60 Marks |
| **Total** | 100 Marks |
| Duration of ESE: 03Hrs 00Min. | |

**Course Objective:**

| | |
|---|---|
| 1 | Understand the fundamental concepts of cloud computing, including its evolution, principles, and characteristics. |
| 2 | Analyze cloud-enabling technologies such as virtualization, REST, and service-oriented architecture. |
| 3 | Evaluate cloud architecture, services, and storage mechanisms to design efficient cloud-based solutions. |
| 4 | Apply resource management techniques and security strategies in cloud environments. |
| 5 | Explore modern cloud technologies, advancements, and their applications in real-world scenarios. |

### Course Contents

| | |
|---|---|
| **Unit I** | **Introduction to Cloud Computing** Definition of Cloud, Evolution of Cloud Computing, Underlying Principles of Parallel and Distributed Computing, Cloud Characteristics, Elasticity in Cloud, On-demand Provisioning. |
| **Unit II** | **Cloud Enabling Technologies and Service-Oriented Architecture** REST and Systems of Systems, Web Services, Publish-Subscribe Model, Basics of Virtualization, Types of Virtualization, Implementation Levels of Virtualization, Virtualization Structures, Tools and Mechanisms, Virtualization of CPU, Memory, and I/O Devices, Virtualization Support and Disaster Recovery. |
| **Unit III** | **Cloud Architecture, Services, and Storage** Layered Cloud Architecture Design, NIST Cloud Computing Reference Architecture, Public, Private, and Hybrid Clouds, IaaS, PaaS, SaaS, Architectural Design Challenges, Cloud Storage, Storage-as-a-Service, Advantages of Cloud Storage, Cloud Storage Providers (S3, Google Cloud Storage). |
| **Unit IV** | **Resource Management and Security in Cloud** Inter-Cloud Resource Management, Resource Provisioning and Resource Provisioning Methods, Global Exchange of Cloud Resources, Security Overview, Cloud Security Challenges, Software-as-a-Service Security, Security Governance, Virtual Machine Security, IAM (Identity and Access Management), Security Standards, AWS Configuration, Cloud Resource Manager. |
| **Unit V** | **Cloud Technologies and Advancements** Hadoop and MapReduce, Virtual Box, Google App Engine, Programming Environment for Google App Engine, OpenStack, Federation in the Cloud, Four Levels of Federation, Federated Services and Applications, Future of Federation. |

| Text Books | |
|---|---|
| T1 | Ritting house, John W and James F. Ransome, Cloud Computing: Implementation, Management and Security, CRC Press, 2017. |
| T2 | Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012. |
| **Reference Books** | |
| R1 | Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, Mastering Cloud Computing, Tata Mcgraw Hill, 2013. |
| R2 | Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing A Practical Approach, Tata Mcgraw Hill, 2009. |
| **Useful Links** | |
| 1 | https://nptel.ac.in/courses/106105167 |
| 2 | https://nptel.ac.in/courses/106104182 |

| Sr. no. | Course Outcomes | CL | Class Session |
|---|---|---|---|
| **1** | **Explain** the concepts of cloud computing, its evolution, characteristics, and elasticity | 2 | 9 |
| **2** | **Illustrate** the principles of parallel and distributed computing and their role in cloud environments. | 3 | 9 |
| **3** | **Analyze** service-oriented architecture, REST, and virtualization techniques for cloud computing. | 4 | 9 |
| **4** | **Implement** resource management techniques and security policies in cloud environments. | 5 | 9 |
| **5** | **Utilize** modern cloud platforms such as Hadoop, OpenStack, and Google App Engine for cloud applications. | 6 | 9 |

HOD
Dept. of Computer Science & Engineering
Tulsiramji Gaikwad Patil College of Engineering & Technology

Dean Academics
Tulsiramji Gaikwad-Patil College Of Engineering and Technology, Nagpur

**Tulsiramji Gaikwad-Patil College of Engineering and Technology**

Wardha Road, Nagpur- 441108

**NAAC Accredited (A+ Grade)**

**An Autonomous Institute affiliated to RTMNU Nagpur**

## Third Year (Semester-VI) B.Tech. (CSE)

## Course Code: BCS33606 (Software Project Management)

| Teaching Scheme | |
|---|---|
| **Lectures** | 4 Hrs/week |
| **Tutorial** | - |
| **Total Credit** | 4 |

| Examination Scheme | |
|---|---|
| **CT-1** | 15 Marks |
| **CT-2** | 15 Marks |
| **CA** | 10 Marks |
| **ESE** | 60 Marks |
| **Total** | 100 Marks |
| Duration of ESE: 03Hrs 00Min. | |

**Course Objective:**

| | |
|---|---|
| 1 | To Summarize the Artifacts of the Software Process, including Management, Engineering, and Programmatic Artifacts, and their role in software development. |
| 2 | To Provide a comprehensive understanding of Model-Based Software Architectures from both Management and Technical Perspectives. |
| 3 | To acquire analytical skills to evaluate various Interaction Planning Processes and assess their impact on project efficiency, risk mitigation, and overall success. |
| 4 | To evaluate Life Cycle Expectations and their influence on software quality, project performance, and overall development efficiency. |
| | |

**Course Contents**

| | |
|---|---|
| **Unit I** | **Conventional Software Management:** The waterfall Model, Conventional Software Management Performance, Evolution of Software Economics: software Economics. Pragmatic Software Cost Estimation. **Improving Software Economics:** Reducing Software Product Size, Improving Software Processes, Improving Team Effectiveness, Improving Automation, Achieving Required Quality, Peer Inspections. |
| **Unit II** | **Conventional and Modern Software Management**: Principles of Conventional Software Engineering, Principles of Modern Software Management, Transitioning to an interactive Process. **Life Cycle Phases:** Engineering and Production Stages Inception, Elaboration, Construction, Transition phases. |
| **Unit III** | **Artifacts of the Process:** The Artifact Sets. Management Artifacts, Engineering Artifacts, Programmatic Artifacts. **Model Based Software Architectures:** A Management Perspective and Technical Perspective. |
| **Unit IV** | **Flows of the Process:** Software Process Workflows. Inter Trans Workflows. Checkpoints of the Process: Major Mile Stones, Minor Milestones, Periodic Status Assessments. **Interactive Process Planning:** Work Breakdown Structures, Planning Guidelines, Cost and Schedule Estimating. Interaction Planning Process, Pragmatic Planning. |

| | |
|---|---|
| **Unit V** | **Project Organizations and Responsibilities:** Line-of-Business Organizations, Project Organizations, and Evolution of Organizations.<br>**Process Automation:** Building Blocks, the Project Environment.<br>**Project Control and Process Instrumentation:** Server Care Metrics, Management Indicators, Quality Indicators, Life Cycle Expectations Pragmatic Software |
| **Text Books** | |
| T1 | Walker Rayce, "Software Project Management", 1998, PEA. |
| T2 | Henrey, "Software Project Management", Pearson. |
| **Reference Books** | |
| R1 | Richard H.Thayer." Software Engineering Project Management", 1997, IEEE Computer Society. |
| R2 | Shere K.D.: "Software Engineering and Management", 1998, PHI. |
| **Useful Links** | |
| 1 | https://onlinecourses.nptel.ac.in/noc19_cs70/preview |
| 2 | https://onlinecourses.nptel.ac.in/noc24_mg01/preview |

| Sr. no. | Course Outcomes | CL | Class Session |
|---|---|---|---|
| **1** | **Understand** the fundamentals of Conventional Software Management and analyze the limitations of the Waterfall Model. | 2 | 9 |
| **2** | **Apply** the principles of Modern Software Management to improve software development practices. | 3 | 9 |
| **3** | **Analyze** the role of Management, Engineering, and Programmatic **Artifacts** in the software development lifecycle. | 4 | 9 |
| **4** | **Evaluate** different Interaction Planning Processes and assess their impact on project efficiency, risk management, and decision-making. | 5 | 9 |
| **5** | **Design** an effective project management framework by integrating organizational structures, process automation strategies, and process instrumentation techniques for efficient project execution. | 6 | 9 |

HOD
Dept. of Computer Science & Engineering
Tulsiramji Gaikwad Patil College of Engineering & Technology

Dean Academics
Tulsiramji Gaikwad-Patil College Of Engineering and Technology, Nagpur

**Tulsiramji Gaikwad-Patil College of Engineering and Technology**

Wardha Road, Nagpur-441108

**NAAC Accredited (A+ Grade)**

**An Autonomous Institute affiliated to RTMNU Nagpur**

## Third Year (Semester-VI) B.Tech. (CSE)

## Course Code: BCS33607 (Data Visualizations Techniques)

| Teaching Scheme | |
|---|---|
| **Lectures** | 4 Hrs/week |
| **Tutorial** | - |
| **Total Credit** | 4 |

| Examination Scheme | |
|---|---|
| **CT-1** | 15 Marks |
| **CT-2** | 15 Marks |
| **CA** | 10 Marks |
| **ESE** | 60 Marks |
| **Total** | 100 Marks |
| Duration of ESE :03 Hrs 00Min. | |

**Course Objective:**

| | |
|---|---|
| 1 | To understand ,analyze effective data visualization to synthesis insights and communicate with complex data clearly. |
| 2 | To apply a visualization method to create effective and insightful representation of data. |
| 3 | To design & implement interactive visualizations using advanced techniques to synthesize complex data insights. |
| 4 | To analyze and evaluate ethical consideration & biases in data visualization to ensure responsible and accurate data representation. |
| 5 | To apply AI technique to visualize and interpret large datasets, enhancing data-driven insights and decision making. |

**Course Contents**

| | |
|---|---|
| **Unit I** | **Unit1: Introduction to Data Visualization**: Importance of visual representation, history and evolution of visualization, principles of effective visualization, Types of data, Visual encoding, Prevailing mistakes in data visualization |
| **Unit II** | **Data Visualization Techniques**: Data typology, Color theory & accessibility (Colorblind-friendly palettes, contrast)Chart design principles (Readability, simplicity, accuracy)Time-Series Data Visualization (Trends & Forecasting)Dashboard design fundamentals, Dashboard Design Principles & Data Storytelling, Designing Effective Dashboard . |
| **Unit III** | **Advanced Visualizations & Interactivity:** Programming-Based: Matplotlib, Seaborn, Plotly, D3.js, ggplot2, Business Intelligence (BI) Tools: Tableau, Power BI, Google Data Studio, loud-Based: Google Charts, Data-wrapper, Advanced Charts: Heat maps, Box Plots, Tree maps, Violin Plots Interactive Visualizations using D3.js & Plotly, Real-time Data Visualization, Geographic Data Visualization (Choropleth Maps, Geospatial Charts) |
| **Unit IV** | **Data Ethics & Bias in Visualization:** Ethical considerations in presenting data, Avoiding manipulation and misrepresentation, Transparency and accountability in visual storytelling |
| **Unit V** | **AI & Big Data Visualization** :Handling large datasets in visualization AI-powered visual insights Automated data storytelling Predictive analytic visualization in recent trends. |

| | |
|---|---|
| **Text Books** | |
| 1 | Big Data Visualization – *James D. Miller,*ISBN-13: 978-1785889295 |
| 2 | The Big Book of Dashboards: Visualizing Your Data Using Real-World Business Scenarios – *Steve Wexler, Jeffrey Shaffer, Andy Cotgreave,*ISBN-13: 978-1119282716 |
| **Reference Books** | |
| 1 | "The Functional Art: An Introduction to Information Graphics and Visualization" – Alberto Cairo |
| 2 | "Interactive Data Visualization for the Web" – Scott Murray |
| 3 | "The Big Book of Dashboards" – Steve Wexler, Jeffrey Shaffer, Andy Cotgreave |
| **Useful Links** | |
| 1 | https://towardsdatascience.com/big-data-visualization-879d52f99ddc |
| 2 | https://www.storytellingwithdata.com/ |

| | Course Outcomes | CL | Class Session |
|---|---|---|---|
| **1** | **Summarize** basic visualization that effectively communicates data patterns and insights. | 2 | 9 |
| **2** | **Design** various visualization methods to represent complex data | 6 | 9 |
| **3** | **Design** and implement interactive visualization that enhances user engagement and data exploration. | 6 | 9 |
| **4** | **Construct** and address ethical issues and biases in visualization to ensure fair, transparent and accurate data representation. | 6 | 9 |
| **5** | **Demonstrate** AI techniques to effectively visualize and analyze large scale datasets for deeper insights and decision making. | 6 | 9 |

HOD
Dept. of Computer Science & Engineering
Tulsiramji Gaikwad Patil College of Engineering & Technology

Dean Academics
Tulsiramji Gaikwad-Patil College Of Engineering and Technology, Nagpur

**Tulsiramji Gaikwad-Patil College of Engineering and Technology**

Wardha Road, Nagpur- 441108

**NAAC Accredited (A+ Grade)**

**An Autonomous Institute affiliated to RTMNU Nagpur**

## Third Year (Semester-VI) B.Tech. (CSE)

## Course Code:BCS33608 (TCP/IP)

| Teaching Scheme | |
|---|---|
| **Lectures** | 4 Hrs/week |
| **Tutorial** | - |
| **Total Credit** | 4 |

| Examination Scheme | |
|---|---|
| **CT-1** | 15 Marks |
| **CT-2** | 15 Marks |
| **CA** | 10 Marks |
| **ESE** | 60 Marks |
| **Total** | 100 Marks |
| Duration of ESE: 03Hrs 00Min. | |

**Course Objective:**

| | |
|---|---|
| 1 | **Tounderstand** the fundamental concepts, architectures, standards, and emerging technologies shaping modern computer networks, including the Internet and IoT. |
| 2 | **To Analyze** skills in network fundamentals, IP addressing, configuration, management, troubleshooting, and security best practices. |
| 3 | **To Apply** fundamental network protocols, IP addressing, configuration, management, troubleshooting, and security practices. |
| 4 | **To Illustrate** the principles, technologies, security considerations, and quality of service mechanisms for delivering multimedia content over IP networks. |
| 5 | **To Examine** the architecture, security features, quality of service mechanisms, and transition strategies of IPv6. |

**Course Contents**

| | |
|---|---|
| **Unit I** | **Introduction to Network Architecture and Technologies**<br>Network architecture, Standards, TCP/IP Model Overview, Internetworking concept, Internet Backbones, NAPs, ISPs, RFCs and Internet Standards, Software-Defined Networking, Network Function Virtualization, Internet of Things IOT Networking |
| **Unit II** | **TCP/IP Protocol Suite and Network Administration**<br>Network Protocols and Services, IP Addressing and Subnetting, Network Interfaces and IP Configuration, DHCP Configuration and Management, DNS Configuration and Troubleshooting, Network Documentation and Management, Backup and Recovery, Network Performance Monitoring, Incident Response and Troubleshooting Logs |
| **Unit III** | **TCP/IP Transport Layer Protocols and Services**<br>Layers of the TCP/IP Model, Role of the Transport Layer, Transmission Control Protocol (TCP), Characteristics of TCP, Connection-Oriented Communication, Reliable Data Transfer, Flow Control and Congestion Control, Error Detection and Correction, User Datagram Protocol (UDP), Characteristics of UDP, Connectionless Communication, Low Latency and Overhead, Transport Layer Services: Multiplexing and Demultiplexing, Flow Control and Congestion Control, Data Segmentation and Reassembly |
| **Unit IV** | **TCP/IP Multimedia Networking and Security**<br>Multimedia introduction, Digitizing audio & Video, Compression, Streaming, RTP, RTCP, Voiceover IP, Email Security, Internet Security, Multimedia over IP Networks, Quality of Service (QOS) for Multimedia, Content Delivery Networks, Secure Real-time Trans ort Protocol. |
| **Unit V** | **TCP/IP IPv6 Networking and IP Security**<br>IP security protocol, IPv6 addresses, Packet format, Multicast, Anycast, ICMPv6, Interoperation between IPv4 and IPv6, QoS, Auto configuration, Secure Neighbor Discovery, Network Address Translation for IPv6 |

| Text Books | |
|---|---|
| T1 | Computer Networks by Andrew S. Tanenbaum and David J. Wetherall |
| T2 | TCP/IP Protocol Suite by Behrouz Forouzan |
| **Reference Books** | |
| R1 | "TCP/IP Illustrated, Volume 1: The Protocols" by W. Richard Stevens and Kevin R. Fall |
| R2 | "Computer Networks: A Systems Approach" by Larry L. Peterson and Bruce S. Davie |
| **Useful Links** | |
| 1 | https://onlinecourses.nptel.ac.in/noc22_cs19/preview |
| 2 | https://archive.nptel.ac.in/courses/106/105/106105084 |

| Sr. no. | Course Outcomes | CL | Class Session |
|---|---|---|---|
| **1** | **Understand** core network architectures, standards, TCP/IP, internetworking, infrastructure, RFCs, and emerging networking technologies like SDN, NFV, and IoT. | 2 | 9 |
| **2** | **Apply** network protocols, IP addressing, configuration, core services, management, and troubleshooting techniques | 3 | 9 |
| **3** | **Analyze** the layers of the TCP/IP model, the role and characteristics of TCP and UDP, and transport layer services like multiplexing, flow, and congestion control. | 4 | 9 |
| **4** | **Outline** multimedia digitization, streaming, security, and quality of service over IP networks. | 4 | 9 |
| **5** | **Interpret** IPv6 addressing, core features, interoperability, and security aspects. | 5 | 9 |

HOD
Dept. of Computer Science & Engineering
Tulsiramji Gaikwad Patil College of
Engineering & Technology

Dean Academics
Tulsiramji Gaikwad-Patil
College Of Engineering
and Technology, Nagpur

**Tulsiramji Gaikwad-Patil College of Engineering and Technology**

Wardha Road, Nagpur- 441108

**NAAC Accredited (A+ Grade)**

**An Autonomous Institute affiliated to RTMNU Nagpur**

## Third Year (Semester-VI) B.Tech. (CSE)

## Course Code: BCS33609 Computer Graphics

| Teaching Scheme | |
|---|---|
| **Lectures** | 4 Hrs/week |
| **Tutorial** | - |
| **Total Credit** | 4 |

| Examination Scheme | |
|---|---|
| **CT-1** | 15 Marks |
| **CT-2** | 15 Marks |
| **CA** | 10 Marks |
| **ESE** | 60 Marks |
| **Total** | 100 Marks |
| Duration of ESE: 03Hrs 00Min. | |

**Course Objective:**

| | |
|---|---|
| 1 | To Understand the Fundamentals of Computer Graphics. |
| 2 | To Analyze Proficiency in Drawing and Clipping Algorithms. |
| 3 | To Apply Geometric Transformations and Viewing Techniques. |
| 4 | To Explore Geometric Modeling Techniques. |
| 5 | To Demonstrate Visible Surface Determination and Rendering Techniques. |

**Course Contents**

| | |
|---|---|
| **Unit-I** | **Introduction:** Introduction to graphics systems, basic elements of computer graphics, applications, and the architecture of raster and random scan display devices, as well as input/output devices. |
| **Unit-II** | **Drawing and Clipping Primitives:** Raster scan line, circle and ellipse drawing algorithms, polygon filling, line clipping, and polygon clipping algorithms. |
| **Unit-III** | **Transformation and Viewing:** Deals with 2D and 3D geometric transformations, 2D and 3D viewing transformations (parallel and perspective projections), and vanishing points. |
| **Unit-IV** | **Geometric Modeling:** Focuses on polygon mesh representation and cubic polynomial curves (Hermite and Bezier). |
| **Unit-V** | **Visible Surface Determination and Surface Rendering:** Includes the Z-buffer algorithm, list-priority algorithm, and area subdivision algorithm for visible surface determination. Also covers illumination and shading models, the RGB color model, and basics of computer animation. |

**Text Books**

| | |
|---|---|
| T1 | D. Hearn, M. Baker, "Computer Graphics – C Version", 2nd Edition, Pearson Education, 2002, ISBN81-7808-794-4 |
| T2 | Grigore C. Burdea, Philippe Coiffet, Virtual Reality Technology second edition, Wiley India Edition, ISBN 81-265-0789-6 |
| T3 | Fundamentals of Computer Graphics, By Peter Shirley, Michael Ashikhmin, Steve Marschner · 2009, ISBN:9781439865521, 1439865523 |

**Reference Books**

| | |
|---|---|
| R1 | D Rogers, "Procedural Elements for Computer Graphics", 2nd Edition, Tata McGraw Hill Publication, 2001, ISBN 0-07-047371-4. |

| | |
|---|---|
| R2 | J Foley. V. Dam, S. Feiner. J. Hughes, "Computer Graphics Principles and Practice", 2nd Edition, Pearson Education, 2003, ISBN 81-7808-038-9 |
| R3 | Foley, "Computer Graphics Principles & Practice in C", 26, ISBN 9788131705056. Pearson Edu |
| **Useful Links** | |
| 1 | **https://nptel.ac.in/course/106/101/106101060/** |
| 2 | **https://nptel.ac.in/courses/106/106/106106131/** |

| Sr. no. | Course Outcomes | CL | Class Session |
|---|---|---|---|
| **1** | **Understand** the Computer graphics systems and display technologies | 2 | 9 |
| **2** | **Implement** fundamental drawing and clipping algorithms | 3 | 9 |
| **3** | **Apply** geometric transformations and viewing techniques in 2D and 3D graphics | 3 | 9 |
| **4** | **Develop** geometric models using curves and polygon meshes | 6 | 9 |
| **5** | **Demonstrate** rendering techniques for realistic graphics and animation | 3 | 9 |

HOD
Dept. of Computer Science & Engineering
Tulsiramji Gaikwad Patil College of Engineering & Technology

Dean Academics
Tulsiramji Gaikwad-Patil
College Of Engineering
and Technology, Nagpur

**Tulsiramji Gaikwad-Patil College of Engineering and Technology**
Wardha Road, Nagpur-441108
**NAAC Accredited (A+ Grade)**
**An Autonomous Institute affiliated to RTMNU Nagpur**

## Third Year (Semester-VI) B.Tech. (CSE)

## Course Code: BCS33610(Network Security)

| Teaching Scheme | |
|---|---|
| **Lectures** | 3Hrs/week |
| **Tutorial** | - |
| **Total Credit** | 4 |

| Examination Scheme | |
|---|---|
| **CT-1** | 15 Marks |
| **CT-2** | 15 Marks |
| **TA** | 10 Marks |
| **ESE** | 60 Marks |
| **Total** | 100 Marks |
| Duration of ESE:03 Hrs 00Min. | |

**Course Objective:**

| | |
|---|---|
| 1 | To understand the fundamental concepts and models of network security. |
| 2 | To analyze the architecture and protocols of TCP/IP and their associated vulnerabilities. |
| 3 | To explore real-time communication security mechanisms and various protocol-based and media-based network attacks. |
| 4 | To apply different security techniques such as firewalls, VPNs, IPSec, and authentication protocols. |
| 5 | To construct secure communication systems with practical tools such as IDS/IPS, proxy servers, and encryption tools.. |

**Course Contents**

| | |
|---|---|
| **Unit I** | **Introduction to Network security**: Model for Network security, Model for Network access security, Real-time Communication Security: Introduction to TCP/IP protocol stack, Implementation layers for security protocols and implications, IPsec: AH and ESP, IPsec: IKE. |
| **Unit II** | **Media- Based-Vulnerabilities**, Network Device Vulnerabilities, Back Doors, Denial of Service (DoS), Spoofing, Man-in-the-Middle, and replay, Protocol -Based Attacks, DNS Attack, DNS Spoofing, DNS Poisoning, ARP Poisoning, TCP/IP Hijacking, Virtual LAN (VLAN), Demilitarization Zone (DMZ) , Network Access Control (NAC), Proxy Server , Honey Pot , Network Intrusion Detection Systems (NIDS) and Host Network Intrusion Prevention Systems Protocol Analyzers, Internet Content Filters, Integrated Network Security Hardware . |
| **Unit III** | **Authentication:** Kerberos, X.509 Authentication Service, Scanning: Port Scanning, Port Knocking- Advantages, Disadvantages. Peer to Peer security. Electronic Mail Security: Distribution lists, Establishing keys, Privacy, source authentication, message integrity, non-repudiation, proof of submission, proof of delivery, message flow confidentiality, anonymity, Pretty Good Privacy (PGP). |
| **Unit IV** | **Firewalls and Web Security**: Packet filters, Application-level gateways, Encrypted tunnels, Cookies. Assignments on latest network security techniques, Security applications in wireless sensor network and wireless Communication networks |
| **Unit V** | **Security Practices and System Security:** Vernam Cipher (One Time Pad), Electronic Mail security, IP Security, Web Security, System Security: Intruders, Malicious Software, viruses, Firewalls. |

| Text Books | |
|---|---|
| T1 | William Stallings, Cryptography and Network Security: Principles and Practice, PHI 3rd Edition, 2006 |
| T2 | Cryptography and networks security principles & practice by William Stalings (Pearson Education prentice Hall). |
| **Reference Books** | |
| 1 | C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd |
| 2 | Behrouz A.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007. |
| **UsefulLinks** | |
| 1 | 1 https://www.geeksforgeeks.org/easy-key-management-in-cryptography/ 2 |
| 2 | https://www.forcepoint.com/cyber-edu/network-security |

| | Course Outcomes | CL | Class Session |
|---|---|---|---|
| **1** | Explain core concepts of network security including models, protocols, and system vulnerabilities. | 2 | 9 |
| **2** | Identify and differentiate various network attacks such as DoS, spoofing, ARP poisoning, and TCP/IP hijacking. | 4 | 9 |
| **3** | Apply encryption techniques like IPsec, Kerberos, PGP, and TLS for securing email and web communications. | 3 | 9 |
| **4** | Evaluate the effectiveness of security solutions such as firewalls, NAC, IDS/IPS, and honeypots in different scenarios. | 5 | 9 |
| **5** | Demonstrate secure network architectures incorporating DMZ, VLANs, proxy servers, and integrated hardware. | 3 | 9 |

HOD
Dept. of Computer Science & Engineering
Tulsiramji Gaikwad Patil College of Engineering & Technology

Dean Academics
Tulsiramji Gaikwad-Patil College Of Engineering and Technology, Nagpur

**Tulsiramji Gaikwad-Patil College of Engineering and Technology**

Wardha Road, Nagpur- 441108

**NAAC Accredited (A+ Grade)**

**An Autonomous Institute affiliated to RTMNU Nagpur**

## Third Year (Semester-VI) B. Tech. (CSE)

## Course Code: BCS33611 (Block Chain & Distributed Ledger System)

| Teaching Scheme | |
|---|---|
| **Lectures** | 4 Hrs/week |
| **Tutorial** | - |
| **Total Credit** | 4 |

| Examination Scheme | |
|---|---|
| **CT-1** | 15 Marks |
| **CT-2** | 15 Marks |
| **CA** | 10 Marks |
| **ESE** | 60 Marks |
| **Total** | 100 Marks |
| Duration of ESE: 03Hrs 00Min. | |

**Course Objective:**

| | |
|---|---|
| 1 | Understand the fundamental concepts, architecture, and design principles of blockchain technology. |
| 2 | Analyze the role and implementation of Distributed Ledger Technology (DLT) in different blockchain applications. |
| 3 | Evaluate various blockchain ecosystems and their governance models. |
| 4 | Apply smart contract concepts and lifecycle for real-world use cases. |
| 5 | Examine blockchain protocols, token economies, and their legal frameworks. |
| | |

### Course Contents

| | |
|---|---|
| **Unit I** | **Foundations of Blockchain:** Blockchain Architecture, Blockchain Design Principles, Blockchain Ecosystem, Challenges and Applications, The Consensus Problem, Asynchronous Byzantine Agreement, AAP Protocol and Its Analysis, Peer-to-Peer Network, Abstract Models: GARAY Model, RLA Model, Proof of Work (PoW), Proof of Stake (PoS) , Based Chains, Hybrid Models. |
| **Unit II** | **Distributed Ledger Technology (DLT):** Origin of Ledgers, Types and Features of DLT, Role of Consensus Mechanism, DLT Ecosystem, Distributed Ledger Implementations, Blockchain and Ethereum, Public and Private Ledgers, Registries and Ledgers, Practitioner Perspective: Keyless Technologies, Transparency as a Strategic Risk, Transparency as a Strategic Asset, Usage of Multiple IDs, Zero Knowledge Proofs, Implementation of Public and Private Blockchain. |
| **Unit III** | **Types of Blockchain Ecosystem:** One-Leader Ecosystem, Joint Venture or Consortia Ecosystems, Regulatory Blockchain Ecosystems, Components in Blockchain Ecosystem: Leaders, Core Group, Active Participants, Users, Third-Party Service Providers, Governance for Blockchain Ecosystems. |
| **Unit IV** | **Smart Contracts:** Anatomy of Smart Contracts, Life Cycle of Smart Contracts, Usage Patterns of Smart Contracts, DLT-Based Smart Contracts Use Cases: Healthcare Industry, Property Transfer. |
| **Unit V** | **Blockchain Protocols:** Ethereum Tokens, Augur, Golem, Understanding Ethereum Tokens, App Coins and Protocol Tokens, Blockchain Token Securities Law Framework, Token Economy, Token Sale Structure Ethereum Subreddit. |

| Text Books | |
|---|---|
| T1 | Dhillon, V., Metcalf, D., and Hooper, M, Blockchain enabled applications, 2017, 1st Agenda Item 65/39 - Annexure - 35 Proceedings of the 65th Academic Council (17.03.2022) 1042Edition, CA: Apress, Berkeley. |
| T2 | Bashir, Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained, 2nd Edition, 2nd Revised edition edition. Birmingham: Packt Publishing, 2018. |
| **Reference Books** | |
| R1 | Dhillon, V., Metcalf, D., and Hooper, M, Blockchain enabled applications, 2017, 1st Agenda Item 65/39 - Annexure - 35 Proceedings of the 65th Academic Council (17.03.2022) 1042Edition, CA: Apress, Berkeley. |
| R2 | Bashir, Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained, 2nd Edition, 2nd Revised edition edition. Birmingham: Packt Publishing, 2018. |
| **Useful Links** | |
| 1 | https://nptel.ac.in/courses/106105235 |
| 2 | https://www.hyperledger.org/use/tutorials |

| Sr. no. | Course Outcomes | CL | Class Session |
|---|---|---|---|
| **1** | **Explain** the fundamentals of blockchain, including architecture, design principles, and ecosystems. | 2 | 9 |
| **2** | **Demonstrate** the role of Distributed Ledger Technology (DLT) and its implementation in blockchain. | 3 | 9 |
| **3** | **Differentiate** between various blockchain ecosystems and governance models. | 4 | 9 |
| **4** | **Design** smart contract-based applications for industries such as healthcare and property transfer. | 5 | 9 |
| **5** | **Evaluate** blockchain token protocols, security frameworks, and token sale structures. | 6 | 9 |

HOD
Dept. of Computer Science & Engineering
Tulsiramji Gaikwad Patil College of Engineering & Technology

Dean Academics
Tulsiramji Gaikwad-Patil College Of Engineering and Technology, Nagpur

**Tulsiramji Gaikwad-Patil College of Engineering and Technology**
Wardha Road, Nagpur- 441108
**NAAC Accredited (A+ Grade)**
**An Autonomous Institute affiliated to RTMNU Nagpur**

## Third Year (Semester-VI) B.Tech. (CSE)

## Course Code:BEC33611(Embedded System)

| Teaching Scheme | |
|---|---|
| **Lectures** | 2 Hrs/week |
| **Tutorial** | - |
| **Total Credit** | 2 |

| Examination Scheme | |
|---|---|
| **CT-1** | 7 Marks |
| **CT-2** | 7 Marks |
| **CA** | 6 Marks |
| **ESE** | 30 Marks |
| **Total** | 50 Marks |
| Duration of ESE: 02Hrs 00Min. | |

**Course Objective:**

| | |
|---|---|
| 1 | To give sufficient background for understanding embedded systems design. |
| 2 | To understand connections of various peripherals with microcontroller based systems. |
| 3 | To Analyze embedded system based on RTOS and communication protocols. |

**Course Contents**

| | |
|---|---|
| **Unit I** | **Introduction to an embedded systems design:** Microcontroller, Memory Devices, Embedded System Project Management, ESD and Co-design issues in System development Process, Design cycle in the development phase for an embedded system, Use of target system or its emulator and In-circuit emulator, Use of software tools for development of an ES, embedding software on target machine. |
| **Unit II** | **Introduction to real time operating systems:** Real Time Operating Systems: OS Services, I/O Subsystems, Interrupt Routines in RTOS Environment, RTOS Task Scheduling model, Interrupt Latency and Response times of the tasks. Case study of embedded systems**.** |
| **Unit III** | **Overview of Microcontroller:** Microcontroller and Embedded Processors, Overview of 8051 Microcontroller family: Architecture, basic assembly language programming concepts, The program Counter and ROM Spaces in the 8051, Data types, 8051 Flag Bits ad PSW Register, 8051 Register Banks and Stack Instruction set, Loop and Jump Instructions, Call Instructions, Time delay generations and calculations, I/O port programming Addressing Modes, accessing memory using various addressing modes, Arithmetic instructions and programs, Logical instructions, Single-bit instruction programming, Programming of 8051 Timers, Counter Programming |

**Text Books**

| | |
|---|---|
| T1 | Raj Kamal, “Embedded Systems”, TMH, 2004. |
| T2 | M.A. Mazidi and J. G. Mazidi, “The 8051 Microcontroller and Embedded Systems”, PHI, 2004.. |

**Reference Books**

| | |
|---|---|
| R1 | Dr. Rajiv Kapadia, “8051 Microcontroller & Embedded Systems”, Jaico Press Society, 2015 |
| R2 | K.J. Ayala, “The 8051 Microcontroller”, Penram International, 1991. |
| R3 | Dr. Prasad, “Embedded Real Time System”, Wiley Dreamtech, 2004. |

**Useful Links**

| | |
|---|---|
| 1 | https://nptel.ac.in/courses/106/105/106105193/ |
| 2 | https://onlinecourses.nptel.ac.in/noc20_ee98/preview |

| Sr. no. | Course Outcomes | CL | Class Session |
|---|---|---|---|
| **1** | **Understand** the concepts of Embedded System design. | 2 | 9 |
| **2** | **Analyze** real time operating systems used to design embedded systems. | 4 | 9 |
| **3** | **Make Use of** a microcontroller for embedded system design. | 3 | 9 |

HOD
Dept. of Computer Science & Engineering
Tulsiramji Gaikwad Patil College of
Engineering & Technology

Dean Academics
Tulsiramji Gaikwad-Patil
College Of Engineering
and Technology, Nagpur