SCHEME OF INSTRUCTION
FOR B.E. VII - VIII SEMESTERS
(MODEL CURRICULUM)

OF

FOUR YEAR DEGREE COURSE

IN

COMPUTER SCIENCE AND ENGINEERING

2021

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)
HYDERABAD – 500 075

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)

SCHEME OF INSTRUCTION AND EXAMINATION

Model Curriculum

B.E. (Computer Science and Engineering)

SEMESTER –VII

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	18BTO01	Basics of Biology	3	0	0	3	30	70	3
2	18CSC28	Compiler Design	3	0	0	3	30	70	3
3	18CSE XX	Professional Elective-IV	3	0	0	3	30	70	3
4	18CSE XX	Professional Elective-V	3	0	0	3	30	70	3
5	18XX O XX	Open Elective-II	3	0	0	3	30	70	3
PRACTICAL									
6	18CSC29	Compiler Design Lab	0	0	3	3	25	50	1.5
7	18CSE XX	Professional Elective-IV Lab	0	0	3	3	25	50	1.5
8	18CSC30	Project: PART-1	0	0	4	-	50	-	2
		TOTAL	**15**	**00**	**10**		**250**	**450**	**20**

L: Lecture T: Tutorial D: Drawing P: Practical

CIE - Continuous Internal Evaluation SEE - Semester End Examination

PROFESSIONAL ELECTIVE-IV	
Course Code	**Title of the Course**
18CSE17	Data Science and Big Data Analytics
18CSE18	Machine Learning
18CSE19	Virtual Reality
18CSE20	Cyber Security

PROFESSIONAL ELECTIVE-V	
Course Code	**Title of the Course**
18CSE21	Software defined Networks
18CSE22	Human Computer Interaction
18CSE23	Neural Networks and Deep Learning
18CSE24	DevOps
18CSE25	Nature Inspired Algorithms

OPEN ELECTIVE-II	
Course Code	**Title of the Course**
18ECO 01	Remote Sensing and GIS
18ECO 03	Design of Fault Tolerant Systems
18ECO 04	Fundamentals of Digital Signal Processing
18CEO 02	Disaster Mitigation and Management
18EGO 01	Technical Writing Skills

PROFESSIONAL ELECTIVE-IV LAB	
Course Code	**Title of the Course**
18CSE26	Data Science and Big Data Analytics Lab
18CSE27	Machine Learning Lab
18CSE28	Virtual Reality Lab
18CSE29	Cyber Security Lab

18BTO01

BASICS OF BIOLOGY

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Course Objectives: The objectives of this course are

1. Understand the milestones reached by human in the field of biology.
2. Understand the human body and its parts.
3. Understand the human anatomy and medical devices.
4. Understand types of advanced therapies.
5. Understand the treatment of toxic pollutants in the environment.
6. Understand genome sequencing and NGS.

Course Outcomes: On Successful completion of the course, students will be able to

1. Provide information about how mankind gained knowledge from olden days to modern days.
2. Explain how the body parts working in the human system.
3. Engineer the medical devices.
4. Analyze the types of advanced treatments in the market.
5. Remediate the toxic pollutants.
6. Sequence the genome of different organisms.

UNIT - I

Introduction to Biology: Classical Vs Modern Biology; Importance of Biological Science and Historical developments; Origin of Life, Urey Miller Experiment, Spontaneous Generation Theory; Three Domains of Life; Principle and Applications of Microscope (Light and Electron Microscope), Prokaryotic and Eukaryotic Cell- Structure and their differences.

UNIT - II

Human Anatomy and Functions-I: Human organ systems and their functions; Skeletal System-Bones, Tendon, Ligaments, principle and applications in knee replacement; Nervous System - Structure of Brain, Spinal Cord, Neuron, Neurotransmitters, Synapse, Alzheimer's - a case study, principle and applications of Imaging Techniques (CT & MRI scans); Circulatory System - Heart structure and functions, principle and applications of cardiac devices (Stent and Pacemaker), Artificial heart, blood components and typing, haemocyto meter.

UNIT - III

Human Anatomy and Functions-II: Respiratory Systems - Lung structure and function, principle and applications of Peak Flow Meter, ECMO (Extra Corporeal Membrane Oxygenation); Excretory Systems-Kidney structure and function, principle and applications of Dialysis; Prenatal diagnosis; Assisted reproductive techniques- IVF, Surrogacy.

UNIT - IV

Medical Biotechnology and Bioremediation: Cells of Immune System, Etiology of cancer, Cancer treatment (Radiation Therapy); Stem Cells and its Clinical applications; Scaffolds and 3D printing of organs; Bio sensors and their applications; Parts of bioreactor and its types; Bioremediation.

UNIT - V

Bioinformatics: Nucleic acid composition, Genetic Code, Amino acid, Polypeptide, Levels of protein structure, Homolog, Ortholog and Paralog, Phylogenetics, Genome Sequencing, Human Genome Project, Next generation sequencing.

Textbooks:

1. Champbell, N.A., Reece, J.B., Urry, Lisa, Cain, M,L., Wasserman, S.A., Minorsky, P.V., Jackson, R.B., "Biology: A global approach", Pearson Education Ltd, Edition 11, 2017.
2. Shier, David, Butler, Jackie, Lewis, Ricki., "Hole's Human Anatomy & Physiology"., McGraw Hill 2012.

Suggested Reading:

1. Bernard R. Glick, T. L. Delovitch, Cheryl L. Patten, "Medical Biotechnology", ASM Press, 2014.

18CSC28

COMPILER DESIGN

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Pre-requisites: Formal Language and Automata Theory, Data Structures, Algorithms.

Course Objectives: The objectives of this course are

1. To understand and list the different stages in the process of compilation.
2. Identify different methods of lexical analysis and design top-down and bottom-up parsers.
3. Identify synthesized and inherited attributes Syntax directed translation schemes and develop algorithms to generate code for a target machine.

Course Outcomes: On Successful completion of the course, students will be able to

1. Identify the concepts related to translator, tokens, bootstrapping porting and phases of the compiler.
2. Use grammar specifications and implement lexical analyzer by the help of compiler tools.
3. Explore the techniques of Top down, Bottom up Parsers and apply parsing methods for various grammars.
4. Implement syntax directed translation schemes and relate Symbol table organization for Block structured and non-Block structured languages.
5. Explain the algorithms to generate code for a target machine code and evaluate.
6. Recognize the errors and apply the recovery strategies for the errors identified by the phases of a compiler.

UNIT - I

Introduction: Overview and Phases of compilation, Boot strapping Porting, Compiler construction Tools, Applications of Compiler technology, Lexical Analysis: Role of lexical Analyzer, Input Buffering, Specification and Recognition of Tokens, Scanner generator (lex, flex).

UNIT - II

Syntax Analysis: LL(1) grammars and top-down parsing, operator grammars, LR(O), SLR(1), CLR(1), LALR(1) grammars and bottom up parsing, ambiguity and LR parsing, LALR(1) parser generator (YACC, BISON).

UNIT - III

Semantic Analysis: Attribute grammars, syntax directed definition, evaluation and flow of attribute in a syntax tree, applications of SDD. **Symbol Table**: Symbol table structure, attributes and management, Run-time environment: Procedure activation, parameter passing, value return, memory allocation and scope.

UNIT - IV

Intermediate Code Generation: Translation of different language features, different types of intermediate forms. Code Improvement (optimization): Analysis: control-flow, data-flow dependence etc.; Code improvement local optimization, global optimization, loop optimization, peep-hole optimization etc.

UNIT - V

Target Code generation: Factors effecting code generation and Basic blocks, Register allocation and target code generation. Instruction scheduling, loop optimization, code generation using dynamic programming, error recovery strategies in phases of compiler.

Textbooks:

1. A.V. Aho, M.S. Lam, R. Sethi, and J.D. Ullman, “Compilers: Principles, Techniques, and Tools”, 2nd Edition, Pearson Education, 2007.
2. K.D. Cooper, and L. Torczon, “Engineering a Compiler”, Elsevier, 2004.
3. Santanu Chattopadhyay, “Compiler Design”, PHI Learning Pvt. Ltd., 2015.

Suggested Reading:

1. Keith D Cooper & Linda Tarezon, “Engineering a Compiler”, Morgan Kafman, Second edition,2004.
2. K.Muneeswaran, “Compiler Design”, first edition, Oxford University Press, 2012.
3. John R Levine, Tony Mason, Doug Brown, “Lex &YACC”, 3rd Edition, Shroff Publishers,2007.

Online Resources:

1. http://iitmweb.iitm.ac.in/phase2/courses/106108113/

18CSC29

COMPILER DESIGN LAB

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	25 Marks
Credits	1.5

Pre-requisites: Basics of Data Structures, Algorithms and Automata Theory.

Course Objectives: The objectives of this course are

1. Defines the rules to implement Lexical Analyzer understand the concept behind the working of compiler tools – Lex, Turbo C, Yacc.
2. Analyze and Apply regular grammar for various source statements expression
3. To implement front end of the compiler by means of generating Intermediate codes, implement code optimization techniques and error handling.

Course Outcomes: On Successful completion of the course, students will be able to

1. Implement the rules for the analysis phase of a compiler.
2. Apply various Syntax analysis techniques on grammars to build the parsers.
3. Generate various intermediate code representations for source code.
4. Explore error recovery strategies and implement Code Optimization, code generation phases.
5. Examine the concepts of compiler tools – Lex, Flex Vision, Yacc, Turbo C.

List of Programs:

1. Design Token Separator for the given Expression
2. Develop a lexical analyzer to recognize a few patterns in C. (Ex. identifiers, constants, comments, operators etc.)
3. Implementation of Lexical Analyzer using JLex, flex or other lexical analyzer generating tools.
4. Build Top Down Parser table
5. Demonstration of working of Shift reduce parser
6. a. Implement Program to recognize a valid arithmetic expression that uses operator +, –, * and /.
   b. Program to recognize a valid variable which starts with a letter followed by any Number of letters or digits.
   c. Demonstration of Calculator using LEX and YACC tool
7. Build LR Parser
8. Simulation of Symbol table Management
9. Generation of a code for a given intermediate code
10. Demonstration of Code Optimization Techniques (Constant Folding).

Textbooks:

1. Keith D Cooper & Linda Tarezon, “Engineering a Compiler”, Morgan Kafman, Second edition,2004.
2. John R Levine, Tony Mason, Doug Brown Lex &Yacc, 3rd Edition Shroff Publisher,2007.

Suggested Reading:

1. Kenneth C Louden, “Compiler Construction: Principles and Practice”, 2nd Edition, Cengage Learning.2005.
2. John R Levine ,Lex&Yacc, Oreilly Publishers,2nd Edition, 2009.

18CSC30

PROJECT: PART-1

Instruction	4 Hours per week
Duration of End Examination	-
Semester End Examination	-
Continuous Internal Evaluation	50Marks
Credits	2

The objective of Project Part -1 is to enable the students to take up investigative study in the broad field of Engineering / Technology, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a supervisor. This is expected to provide a good initiation for the student(s) towards R&D. The work shall include:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/ Modelling / Simulation / Experiment / Design /Feasibility;
4. Preparing a Written Report on the Study conducted for Presentation to the Department;
5. Final Seminar, as oral Presentation before the Department Review Committee.

Guidelines for the award of Marks: Max. Marks: 50

Evaluation by	Max. Marks	Evaluation Criteria / Parameter
Supervisor	20	Project Status / Review
	5	Report
Department Review Committee	5	The relevance of the Topic
	5	PPT Preparation
	5	Presentation
	5	Question and Answers
	5	Report Preparation

18CSE17

DATA SCIENCE AND BIG DATA ANALYTICS
(PROFESSIONAL ELECTIVE-IV)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Prerequisites: Probability and Statistics, Data Base Management Systems.

Course Objectives: The objectives of this course are

1. Introduce a data analytics problem solving framework.
2. Develop technical skills in probability modeling and statistical inference for the practical application of statistical methods.
3. Use existing and develop new statistical tools for data science problems across different applied domains.

Course Outcomes: On Successful completion of the course, students will be able to

1. Describe Data Discovery, Data Preparation, Model Planning and Building, communicate results, operationalize phases of data analytics life cycle and Evaluation of data using statistical methods, ANOVA.
2. Predict the approaches for grouping similar objects using Least Squares, Nearest Neighbors and identify frequent patterns using Apriori algorithm, FP-Growth.
3. Examine Time Series Analysis using ARIMA and representation, processing and analysis of textual data to derive useful insights using TFIDF.
4. Recall Velocity, variety, volume, veracity of big data. Examples of big data and Risks, Crowd sourcing analytics of Big data technologies.
5. Outline the Architecture of Apache Hadoop HDFS and Map Reduce operations to perform filtering, Job Tracking and restructuring data.
6. Explain types, benefits of No SQL databases and identify applications of stream data model, query processing and optimization techniques.

UNIT-I

Data Analytics Life cycle: Data Analytics Life cycle Overview, Discovery, Data Preparation, Model Planning, Model Building, Communicate Results, Operationalize. Exploratory Data Analysis, Statistical Methods for Evaluation, ANOVA.

UNIT-II

Overview of Supervised Learning: Variable Types and Terminology, Two Simple Approaches to Prediction: Least Squares and Nearest Neighbors, Model Selection and Bias–Variance Tradeoff. Association Analysis: Association rules, Apriori algorithm, FP-Growth Technique.

UNIT-III

Time Series Analysis: Overview of Time Series Analysis, ARIMA Model. Text Analysis: Text Analysis Steps, Stop Word Removal, Tokenization, Stemming and Lemmatization, Representing Text: Term-Document Matrix, Term Frequency--Inverse Document Frequency (TFIDF).

UNIT-IV

Introduction to Big Data: Defining big data, 4 V's of big data, Big data types, Analytics, Examples of big data, Big data and Data Risk, Big data technologies, benefits of big data, Crowd sourcing analytics. Hadoop Distributed File Systems: Architecture of Apache Hadoop HDFS, Other File Systems, HDFS File Blocks, HDFS File Commands.

UNIT-V

No SQL Data Management: Types of NoSQL data bases, Benefits of No SQL. Map Reduce: Introduction, Map reduce example, Job Tracker, Map Operations. Data Stream Mining: The stream data model, streaming applications, continuous query processing and optimization, Distributed query processing.

Textbooks:

1. EMC Education Services “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data” Wiley Publishers, 2012.
2. Hastie, Trevor, et al., “The elements of statistical learning: Data Mining, Inference, and Prediction”, Vol. 2. No. 1. New York: Springer, 2009.
3. V.K. Jain, “Big Data & Hadoop”, Khanna Publishing House,2017.

Suggested Reading:

1. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
2. Mark Gardener, “Beginning R The statistical Programming Language”, Wiley, 2015.
3. Han, Kamber, and J Pei, “Data Mining Concepts and Techniques”, 3rd edition, Morgan Kaufman, 2012.
4. Big Data Black Book, DT Editorial Services, Wiley India.
5. V.K. Jain, “Data Science & Analytics”, Khanna Publishing House
6. Jeeva Jose, “Beginner’s Guide for Data Analysis using R Programming”, ISBN: 978-93-86173454.
7. Montgomery, Douglas C., and George C. Runger “Applied statistics and probability for engineers”, John Wiley & Sons, 6th edition, 2013.

18CSE18

MACHINE LEARNING
(PROFESSIONAL ELECTIVE-IV)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Pre-requisites: Linear Algebra and Probability theory basics.

Course Objectives: The objectives of this course are
1. Understand the need and elements of Machine Learning.
2. Study various machine learning techniques.
3. Design solutions for real world problems using machine learning techniques.

Course Outcomes: On Successful completion of the course, students will be able to
1. Define the basic concepts related to Machine Learning.
2. Recognize the underlying mathematical relationships within and across Machine Learning algorithms and their paradigms.
3. Determine the various applications of Machine Learning.
4. Model the problems using various machine learning techniques.
5. Design and develop solutions to real world problems using Machine Learning Algorithms.
6. Evaluate and interpret the results of the various machine learning techniques.

UNIT - I

Introduction to Machine Learning: Introduction, Classic and Adaptive machines, learning types, deep learning, bio-inspired adaptive systems, Machine Learning and big data; **Elements of Machine Learning:** Data formats, Learnability, Statistical learning concepts, Class balancing, Elements of Information theory.

UNIT - II

Feature Selection and Feature Engineering: Data sets, Creating training and test sets, managing categorical data, missing features, data scaling and normalization, Withering, Feature selection and filtering, PCA, Visualization of high-dimensional datasets; **Regression Algorithms**: Linear models for regression, Regression types; **Linear Classification Algorithms:** Linear classification, logistic regression, grid search, classification metrics, ROC curve.

UNIT - III

Naïve Bayes and Discriminant Analysis: Bayes theorem, Naïve Bayes classifiers, Discriminant analysis; **Support Vector Machines**: Linear SVM, Kernel-based classification; **Decision Trees and Ensemble Learning**: Binary Decision trees, Introduction to Ensemble Learning-Random Forests, AdaBoost, Gradient Tree Boosting, Voting classifier.

UNIT - IV

Clustering Fundamentals: Basics, k-NN, Gaussian mixture, K-means, Evaluation methods, DBSCAN, Spectral Clustering, Hierarchical Clustering; **Introduction to Neural Networks**: Introduction to deep learning, MLPs with Keras, deep learning model layers, introduction to Tensorflow.

UNIT - V

Machine Learning Architectures: Data collection, Normalization and regularization, Dimensionality reduction, Data augmentation, Modeling/Grid Search/Cross-validation, Visualization, GPU support, Introduction to distributed architectures, Scikit-learn tools for ML architectures, pipelines, Feature unions

Textbooks:
1. Giuseppe Bonaccorso, “Machine Learning Algorithms”, 2nd Edition, Packt, 2018,
2. Tom Mitchel “Machine Learning”, Tata Mc GraW Hill, 2017

Suggested Reading:
1. Abhishek Vijavargia “Machine Learning using Python”, BPB Publications, 1st Edition, 2018.
2. Reema Thareja “Python Programming”, Oxford Press, 2017.

3. Yuxi Liu, “Python Machine Learning by Example”, 2nd Edition, PACT, 2017.

Online Resources:

1. https://www.guru99.com/machine-learning-tutorial.htm
2. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
3. https://www.geeksforgeeks.org/machine-learning/

18CSE19

VIRTUAL REALITY
(PROFESSIONAL ELECTIVE-IV)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Course Objectives: The objectives of this course are

1. To provide detailed understanding of the concepts of Virtual Reality
2. Understand geometric modeling and virtual environment
3. Prepare the students to develop Virtual Reality applications

Course Outcomes: On Successful completion of the course, students will be able to

1. List the virtual environment requirements and benefits of virtual reality
2. Familiarize with various VR technologies and models of interactions in VR systems
3. Simulate flight dynamics of an aircraft in virtual environment
4. Identify the virtual hardware andsoftware for modeling real world environments
5. Develop Virtual Reality applications
6. Explore the applications of VR in training, engineering, entertainment and science.

UNIT - I

Introduction to Virtual Reality- Introduction, Computer Graphics, real time computer graphics, flight simulation, virtual environment requirement, benefits of virtual reality, historical development of VR, scientific landmark.

3DComputer Graphics: Introduction, virtual world space, positioning the virtual observer, perspective projection ,human vision, stereo perspective projection, 3D clipping, color theory, simple 3D modelling, illumination models, reflection models, shading algorithms, radiosity, hidden surface removal, realism-stereographic image.

UNIT - II

Geometric Modeling: Introduction, 2d to 3D, 3D space curves, 3D boundary representation, **Geometric Transformations:** Introduction, frames of reference, modeling transformations, instances, picking, flying, scaling the VE, collision detection.

Generic VR system: Introduction, virtual environment, computer environment, VR technology, Model of interaction, VR systems.

UNIT - III

Virtual Environment: Introduction, dynamics of numbers, linear and on-linear interpolation, animation of objects, linear and non-linear translation, shape and object in between, free from deformation, particle system, **Physical Simulation:** Introduction, objects falling in a gravitational field, rotating wheels, elastic collisions, projectiles, simple pendulum, springs and flight dynamics of an aircraft.

UNIT - IV

VR Hardware and Software: Human factors-eyes, ear and somatic senses;

VR Hardware: Introduction, sensor hardware, head-coupled displays, acoustic hardware, integrated VR system;

VR Software: Modeling virtual world, physical simulation, VR tool kits, introduction to VRML.

UNIT - V

VR Applications: Engineering, Entertainment, Science, Training,

Future: Virtual environment, modes of interaction.

Textbooks:

1. John Vince,"Virtual Reality Systems",Pearson Education, Asia,2007
2. Anand R.,"Augmented and Virtual Reality", Khanna Publishing House, Delhi
3. Steve M Lavalle, "Virtual Reality", Cambridge University Press, 2017

Suggested Reading:

1. Adams,"VisualizationofVirtualReality",TataMcGrawHill,2000
2. GrigoreC.Burdea,PhilippeCoiffet,"VirtualRealityTechnology",Wiley InterScience,2nd Edition,2006
3. William R Sherman, Alan B Craig, "Understanding Virtual Reality: Interface, Applications and Design", Morgan Kaufman,2 008

Online Resources:

1. www.vresources.org
2. www.vrac.iastate.edu
3. www.w3.org/MarkUp/VRM
4. https://nptel.ac.in/courses/106106139

18CSE20

CYBER SECURITY
(PROFESSIONAL ELECTIVE-IV)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Pre-requisites: Operating System, Computer Network, Cryptography.

Course Objectives: The objectives of this course are

1. To Identify and present indicators that a cybercrime has occurred and understand methods and tools used in cybercrimes.
2. To collect, Process, Analyze and Present Computer Forensics Evidence.
3. To understand the legal perspectives and Organizational implications of Cyber Security.

Course Outcomes: On Successful completion of the course, students will be able to

1. List the different types of cybercrimes and analyze legal frameworks to handle cybercrimes.
2. Identify the Tools and Methods used in cybercrimes.
3. Analyze and resolve cyber security issues and laws governing Cyberspace.
4. Describe the need of Digital Forensics and the importance of digital evidence in prosecution.
5. Interpret the commercial activities in the event of significant information security incidents in the Organization.
6. Discuss the vulnerabilities in networking protocols and their mitigation techniques.

UNIT - I

Introduction to Cyber Crime: Cyber Crime: Definition and Origins of the Word, Cyber crime and Information Security, Classification of Cyber Crimes, Cyber Crime: The Legal Perspective, Cyber Crime: An Indian Perspective, A Global Perspective of Cyber Crime.

UNIT - II

Cyber Offenses: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector. Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT - III

Cyber Security: The Legal Perspectives: Cyber Crime and the Legal Landscape around the World, Need of Cyber laws: the Indian Context, The Indian IT Act, Challenges to Indian Law and Cyber Crime Scenario in India, Digital Signatures and the Indian IT Act, Cyber Crime and Punishment, Cyber Law, Technology and Students: The Indian Scenario.

UNIT - IV

Understanding Cyber Forensics: Introduction ,Digital Forensics Science, Need for Computer Forensics, Cyber Forensics and Digital Evidence, Forensics Analysis of Email, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Cyber Forensics Investigation, Challenges in Computer Forensics.

UNIT - V

Cybersecurity: Organizational Implications: Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

Textbooks:

1. Sunit Belpre and Nina Godbole, “Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives”, Wiley India Pvt,Ltd,2011
2. Kevin Mandia, Chris Prosise, “Incident Response and computer forensics”, Tata McGraw Hill, 2006.

Suggested Reading:

1. Alfred Basta, Nadine Basta, Mary Brown, Ravinder Kumar, “Cyber Security and Cyber Laws”, Paperback – 2018.
2. Mark F Grady, FransescoParisi, “The Law and Economics of Cyber Security”, Cambridge university press, 2006.

Online Resources:

1. https://www.edx.org/learn/cybersecurity
2. https://www.coursera.org/courses?query=cyber%20security
3. https://swayam.gov.in/course/4002-cyber-law

18CSE21

SOFTWARE DEFINED NETWORKS
(PROFESSIONAL ELECTIVE-V)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Pre-requisites: Fundamentals of Operating Systems, Knowledge of Data Communications and Computer Networks.

Course Objectives: The objectives of this course are

1. To understand the need and fundamentals of Software Defined Networks.
2. To discuss the hardware and software components required by the data centers.
3. To study about the SDN solutions for data centers and Programming.

Course Outcomes: On Successful completion of the course, students will be able to

1. Describe the evolution of modern data centers.
2. Identify the components of Software Defined Networks and their use.
3. Build Software Defined Network solutions for Data Center Network including VLANs, EVPN, VxLAN and NVGRE.
4. Explore the features of Juniper SDN frame work.
5. Evaluate Open SDN API and Hypervisor based overlays.
6. Design and develop solutions for Data Centers using SDN frameworks.

UNIT - I

Introduction: History of Software Defined Networking (SDN), Modern Data Center, Traditional Switch Architecture, need for SDN, Evolution of SDN, Working of SDNs, Centralized and Distributed Control and Data Planes.

UNIT - II

Open Flow & SDN Controllers: Open Flow Specification, Drawbacks of Open SDN, SDN via APIs, SDN via Hypervisor Based Overlays, SDN via Opening up the Device, SDN Controllers, General Concepts.

UNIT - III

Data Centers: Multi-tenant and Virtualized Multi-tenant Data Center, SDN Solutions for the Data Center Network, VLANs, EVPN, VxLAN, NVGRE.

UNIT - IV

SDN Programming: Programming SDNs, Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs, Network Functions Virtualization (NFV) and Software Defined Networks Concepts, Implementation and Applications.

UNIT - V

SDN: Juniper SDN Framework, IETF SDN Framework, Open Daylight Controller, Floodlight Controller, Bandwidth Calendaring, Data Center Orchestration.

Textbooks:

1. Paul Goransson and Chuck Black, “Software Defined Networks: A Comprehensive Approach”, First Edition, Morgan Kaufmann, 2014.
2. Thomas D. Nadeau, Ken Gray, “SDN: Software Defined Networks”, O’Reilly Media, 2013.

Suggested Reading:

1. Siamak Azodolmolky, “Software Defined Networking with Open Flow”, Packet Publishing, 2013.
2. Vivek Tiwari, “SDN and Open Flow for Beginners”, Amazon Digital Services, Inc., 2013.
3. Fei Hu, Editor, “Network Innovation through Open Flow and SDN: Principles and Design”, CRC Press, 2014.

18CSE22

HUMAN COMPUTER INTERACTION
(PROFESSIONAL ELECTIVE-V)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Course Objectives: The objectives of this course are

1. Provide the foundations of Human Computer Interaction.
2. Familiarize with the design technologies for computer interaction.
3. Explore the design strategies, guidelines, models and theories for developing a user friendly interface.

Course Outcomes: On Successful completion of the course, students will be able to

1. Identify Shneiderman, Stone and Nielsen paradigms for interaction between Human and computer.
2. Distinguish the usability of Goals, Measures, Motivations to solve real-time applications.
3. Interpret the command languages and models used in communication and collaboration with interconnected entities.
4. Outline the Process, Frameworks, Methods, Tools for Designing interactive systems, and Relate the Social Impact Analysis, Legal Issues.
5. Review user experiences Familiarize with nonanthromorphic design and models of System Response Time impacts.
6. Analyze the Extended, Augmented, Mixed and Virtual Reality techniques to deal with real-time applications.

UNIT – I

Foundations: The human, The Computer, The Interaction, Paradigms Usability of Interactive **System:** Introduction, Usability Goals and Measures, Usability Motivations, Goals for Our Profession.

UNIT – II

Expressive Human and Command Languages: Introduction, Speech Recognition, Speech Production, Human Language Technology, Traditional Command Languages.

Communication and Collaboration: Introduction, Models of Collaboration, Specific Goals and Contexts, Design Considerations.

UNIT –III

Design: Introduction, Organizational Support for Design, The Design Process, Design Frameworks, Design Methods, Design Tools, Social Impact Analysis, Legal Issues.

Evaluation and the User Experience: Introduction, Expert Reviews and Heuristics, Usability Testing and Laboratories, Acceptance Tests, Controlled Psychologically Oriented Experiments.

UNIT - IV

Advancing the User Experience: Introduction, Display Design, View (Window) Management, Animation, Webpage Design, Color, Nonanthropomorphic Design, Error Messages.

The Timely User Experience: Introduction, Models of System Response Time (SRT) Impacts, Expectations and Attitudes ,User Productivity and Variability in SRT, Frustrating Experiences.

UNIT – V

Immersive Virtualization: Introduction, Extended and augmented Reality, Mixed and Virtual Reality, Implications.

Multimodality and Gamification: Introduction, multimodal interfaces and interaction, Haptics, Virtual environments.

Textbooks:

1. Ben Shneiderman, Plaisant, Cohen, Jacobs, Elmqvist“ Designing the User Interface”, 6thEdition. 2017.
2. Ole Goethe.”Gamification Mindset”, Springer International Publishing, Year: 2019.

Suggested Reading:

1. Alan Dix, Janet Finlay, Gregory D. Abowd, Russell Beale, “Human Computer Interaction”, 3rd edition, Pearson Education Limited, 2004.
2. Lele Nielsen ”User Focused Design” second edition,Springer,2019.

Online Resources:

1. https://www.coursera.org/course?query=human+computer+interaction
2. https://nptel.ac.in/courses/106/106/106106177/
3. https://www.researchgate.net/publication/300673474TeachingHuman-Computer Interaction

18CSE23

NEURAL NETWORKS AND DEEP LEARNING
(PROFESSIONAL ELECTIVE-V)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Pre-requisites: Neural Networks, Machine Learning.

Course Objectives: The objectives of this course are

1. To learn various types of learning techniques and their applications.
2. To acquire the knowledge of neural network architectures, learning methods and algorithms.
3. To understand Deep learning algorithms and their applications.

Course Outcomes: On Successful completion of this course, student will be able to

1. Understand various learning models.
2. Design and develop various Neural Network Architectures.
3. Apply approximate reasoning using Convolution Neural Networks.
4. Identify new application requirements in the field of computer vision.
5. Design Neural Network with Deep learning techniques to solve different applications.
6. Evaluate the Accuracy of different models of Deep learning networks.

UNIT - I

Artificial Neural Networks: Fundamental concepts, Evolution of neural networks, Basic models of artificial neural network, important terminologies of ANNs. McCulloch-Pitts neuron, Perceptrons, Perceptron Learning Algorithm. Sigmoid Neurons, Feed forward Neural Networks, Representation Power of Feed forward Neural Networks

UNIT - II

Supervised Learning Neural Networks: Adaptive linear neuron (Adaline), Multiple Adaptive linear neuron (Madaline), Back propagation, Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMS Prop, Adam,

UNIT – III

Unsupervised Learning Neural Networks: Kohonenself organizing networks, Adaptive resonance theory.

Associate Memory Networks: Bidirectional associative memory network, Hopfield networks.

Auto encoders : relation to PCA, Regularization in auto encoders, Denoising auto encoders, Sparse auto encoders, Contractive auto encoders

Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Dropout, Greedy Layer wise Pre-training, Better activation functions, Better weight initialization methods, Batch Normalisation

UNIT - IV

Convolutional Neural Network: The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Innitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types. LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Visualizing Convolutional Neural Networks, Guided Back propagation, Deep Dream, Deep Art, Fooling Convolutional Neural Networks

UNIT – V

Recurrent Neural Networks : Back propagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs, Encoder Decoder Models, Attention Mechanism, Attention over images

Text Books:

1. S.N.Sivanandam&S.N.Deepa, “Principles of soft computing”, Wiley publications, 2nd Edition, 2008.
2. Goodfellow. I., Bengio. Y. and Courville. A., “Deep Learning”, MIT Press, 2016.
3. Charu C Aggarwal, “Neural Networks & Deep Learning”, springer International publishing, 2018.

Suggested Reading:

1. S.Rajasekaran&G.A.Vijayalakshmipai, "Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & Applications", PHI publication, 2008.
2. LiMin Fu, “Neural Networks in Computer Intelligence”, McGraw-Hill edition, 1994.

3. K.L.Du& M.N.S Swamy, "Neural Networks in a Soft Computing Framework", Springer International edition, 2008.
4. Simon Haykins, "Neural Networks a Comprehensive Foundation", PHI, second edition.
5. Bishop C.M., “Pattern Recognition and Machine Learning”, Springer, 2006.

18CSE24

DevOps
(PROFESSIONAL ELECTIVE-V)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Prerequisite: Object-oriented Programming

Course Objectives: The main objectives of this course are to
1. Describe the agile relationship between development and IT operations.
2. Understand the skill sets and high-functioning teams involved in DevOps and related methods to reach a continuous delivery capability
3. Implement automated system update and DevOps lifecycle

Course Outcomes: On successful completion of this course, students will be able to:
1. Identify components of Devops environment
2. Describe Software development models and architectures of DevOps
3. Apply different project management, integration, testing and code deployment tool
4. Investigate different DevOps Software development models
5. Assess various Devops practices
6. Collaborate and adopt Devops in real-time projects

UNIT-I
Introduction: Introduction, Agile development model, DevOps, and ITIL. DevOps process and Continuous Delivery, Release management, Scrum, Kanban, delivery pipeline, bottlenecks, examples

UNIT-II
Software development models and DevOps: Waterfall, Spiral, RAD model, Agile Development, 7 C's of DevOps Lifecycle for Business Agility, DevOps, and Continuous Testing.
DevOps influence on Architecture: Introducing software architecture, The monolithic scenario, Architecture rules of thumb, The separation of concerns, Handling database migrations, Microservices, and the data tier, DevOps, architecture, and resilience.

UNIT-III
Introduction to project management: The need for source code control, The history of source code management, Roles and code, source code management system and migrations, Shared authentication, Hosted Git servers, Different Git server implementations, Docker intermission, Gerrit, The pull request model, GitLab.
Integrating the system: Build systems, Jenkins build server, Managing build dependencies, Jenkins plugins, and file system layout, The host server, Build slaves, Software on the host, Triggers, Job chaining and build pipelines, Build servers and infrastructure as code, Building by dependency order, Build phases, Alternative build servers, Collating quality measures.

UNIT-IV
Testing Tools and automation: Various types of testing, Automation of testing Pros and cons, Selenium - Introduction, Selenium features, JavaScript testing, Testing backend integration points, Test-driven development, REPL-driven development
Deployment of the system: Deployment systems, Virtualization stacks, code execution at the client, Puppet master and agents, Ansible, Deployment tools: Chef, SaltStackand Docker

UNIT-V
Code monitoring and Issue Tracking: Code monitoring tools: Nagios, Munin, Ganglia, Log handling. Introduction to issue trackers, Need of issue tracker: Workflows and issues, Problems with issue tracker proliferation, Trackers tools: Bugzilla, GitLab tracker, andJira

Textbooks

1. Joakim Verona. Practical Devops, Second Edition. Ingram short title; 2nd edition (2018). ISBN-10: 1788392574
2. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's Viewpoint. Wiley publications. ISBN: 9788126579952

Reference books

1. Len Bass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. Addison Wesley; ISBN-10: 9780134049847

18CSE25

NATURE INSPIRED ALGORITHMS
(PROFESSIONAL ELECTIVE-V)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Pre-requisites: Design and Analysis of Algorithms, Discrete Mathematics.

Course Objectives: The objectives of this course are

1. Understand the fundamentals of nature inspired techniques which influence computing.
2. Study the Swarm Intelligence and Immuno computing techniques.
3. Familiarize the DNA Computing.

Course Outcomes: On Successful completion of the course, students will be able to

1. Identify the relation between computers (computing) and natural processes.
2. Describe concepts of Evolutionary Computing like Genetic Algorithms to solve engineering optimization problems.
3. Apply Swarm Intelligence like ACO and PSO to Travelling Salesman Problem.
4. Explain Danger theory and its role in various Immuno Computing Models.
5. Solve the SAT problem by using DNA manipulation functions and Filtering Models.
6. Familiarize with test tube programming.

UNIT - I

Introduction: From Nature to Nature Computing, Philosophy, Three Branches-A Brief Overview, Individuals, Entities and agents - Parallelism and Distributivity, Interactivity ,Adaptation-Feedback-Self-Organization-Complexity, Emergence, Bottom-up vs. Top-Down- Determination, Chaos and Fractals.

UNIT - II

Computing Inspired by Nature: Evolutionary Computing, Hill Climbing and Simulated Annealing, Darwin's Dangerous Idea, Genetics Principles, Standard Evolutionary Algorithm -Genetic Algorithms, Reproduction-Crossover, Mutation, Evolutionary Programming, Genetic Programming.

UNIT – III

Swarm Intelligence: Introduction - Ant Colonies, Ant Foraging Behavior, Ant Colony Optimization, SACO and scope of ACO algorithms, Ant Colony Algorithm (ACA), Swarm Robotics, Foraging for food, Social Adaptation of Knowledge, Particle Swarm Optimization (PSO).

UNIT - IV

Immuno Computing: Introduction- Immune System, Physiology and main components, Pattern Recognition and Binding , Immune Network Theory- Danger Theory, Evaluation, Interaction- Immune Algorithms , Introduction – Genetic algorithms, Bone Marrow Models, Forest's Algorithm, Artificial Immune Networks.

UNIT – V

Computing With New Natural Materials: DNA Computing- Motivation, DNA Molecule, Adleman's experiment, Test tube programming language, Universal DNA Computers, PAM Model, Splicing Systems, Lipton's Solution to SAT Problem, Scope of DNA Computing, From Classical to DNA Computing.

Textbooks:

1. Leandro Nunes de Castro, " Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group, 2007.
2. Floreano D. and Mattiussi C., "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", MIT Press, Cambridge, MA, 2008.

Suggested Reading:

1. Albert Y.Zomaya, "Handbook of Nature-Inspired and Innovative Computing", Springer, 2006.
2. Marco Dorrigo, Thomas Stutzle, "Ant Colony Optimization", PHI,2005.

18ECO01

REMOTE SENSING AND GIS
(OPEN ELECTIVE-II)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Course Objectives: The objectives of this course are

1. Explain the fundamental concepts of remote sensing and digital imaging techniques.
2. Make the students to understand the principles of thermal and microwave remote sensing.
3. Make the students understand the significance of GIS and the process of GIS.

Course Outcomes: On Successful completion of the course, students will be able to

1. Demonstrate the understanding of basic concepts of remote sensing and interpret energy interactions.
2. Choose an appropriate technique for a given scenario by appreciating the types of remote sensing.
3. Distinguish the principle behind the working of microwave and LiDAR sensing.
4. Apply an appropriate data model from the acquired knowledge of the basics of GIS.
5. Explain the procedure for encoding data and geospatial data analysis.

UNIT-I

Concept of Remote Sensing: Remote sensing definition, data, process, EM bands used in remote sensing, Interactions and recording of energy: interaction with atmosphere, interaction with earth surface features (soil, water, vegetation), recording of energy by sensors, Transmission, reception and processing, Image interpretation and analysis, Applications, Advantages and limitations of Remote sensing, Orbits of Remote sensing satellites, Indian remote sensing satellites.

UNIT-II

Digital Imaging: Types of Remote sensing, Sensor resolutions, Digital Image, Sensor components, Principle of a long-track and across-track scanning, Hyperspectral Imaging, Thermal Remote Sensing.

UNIT-III

Microwave Remote Sensing: Active and Passive Microwave Remote Sensing, Radar Imaging: Key components of imaging radar, viewing geometry, spatial resolution, principle of RAR, SAR and their range resolution, Satellite Radar Imaging, LIDAR.

UNIT-IV

Concept of Geographic Information Systems: Key components of GIS, joining spatial and attribute data, functions, advantages and applications of GIS, Spatial data model, Raster data model, Vector data model.

UNIT-V

Process of GIS and Geospatial analysis: Data sources, encoding raster data, encoding vector data, encoding attribute data, linking spatial and attribute data, Geospatial data analysis methods database query, geospatial measurement, overlay operations, network analysis and surface analysis. Integration of GIS and remote sensing.

Textbooks:

1. Basudeb Bhatta, “Remote Sensing and GIS”, 2/e, Oxford University Press, 2012.
2. Lillesand T.M., and Kiefer R.W. “Remote Sensing and Image Interpretation”, 6/e, John Wiley &Sons, 2000.

Suggested Reading:

1. James B. Campbell and Randolph H. Wynne, “Introduction to Remote Sensing”, the Guilford Press, 2011.
2. Michael N DeMers, “Fundamentals of GIS”, 2/e, John Wiley, 2008.

18EC O03

DESIGN OF FAULT TOLERANT SYSTEMS
(OPEN ELECTIVE-II)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Course Objectives: The objectives of this course are

1. The course provides basic concepts of various faults & failures occur in digital systems and test vector generation to identify the faults.
2. To understand concept of redundancy and design of self-checking circuits.
3. To understand built in self-test and its testability into logic circuits.

Course Outcomes: On Successful completion of the course, students will be able to

1. Identify various types of faults & failures and analyze reliability of systems
2. Model and evaluate redundancy concept in digital systems
3. Construct fail safe and self-checking circuits
4. Develop testable combinational digital circuits
5. Design of built in self-test for VLSI circuits

UNIT – I

Basic Concepts: Reliability concepts: Failures and faults, Reliability and failure rate, Relation between Reliability & Mean Time between Failure (MTBF), Maintainability & Availability, reliability of series and parallel systems. Modeling of faults, Introduction to test generation for combinational logic circuits: conventional methods, random testing, transition count testing and signature analysis.

UNIT – II

Fault Tolerant Design: Basic concepts: Static, Dynamic and Hybrid redundancy. NMR, Triple modular redundancy (TMR) system, self-purging redundancy, Sift out Modular Redundancy (SMR). Use of error correcting codes, time redundancy, software redundancy.

UNIT – III

Self Checking Circuits And Fail-Safe Logic: Design of totally self-checking checkers, checkers using m-out of n-codes, Berger codes and low-cost residue code, self-checking sequential machines, partially self-checking circuits. Fail safe Design: Strongly fault secure circuits, fail-safe design of sequential circuits using partition theory and Berger codes, totally self-checking PLA design.

UNIT- IV

Design For Testability For Combinational Circuits: Basic concepts of testability, controllability and observability, the Reed Muller's expansion technique, OR-AND-OR design, use of control and syndrome testable design.

UNIT -V

Built InSelf Test: BIST concepts, Built in Digital Circuit Observer (BIDCO), built-in-test of VLSI chips, Design for autonomous self-test, designing testability into logic boards, generic offline BIST architecture.

Textbooks:

1. Parag K. Lala, Fault Tolerant & Fault Testable Hardware Design, PHI, 1985
2. Parag K. Lala, Digital systems Design using PLD's, PHI, 1990.
3. M. Abramovili, M.A. Breues, A. D. Friedman – "Digital Systems Testing and Testable Design" J Aico publications.

Suggested Reading:

1. N.N. Biswas, Logic Design Theory, PHI, 1993.
2. KonadChakraborthy& Pinaki Mazumdar, Fault tolerance and Reliability Techniques for high density random – access memories Reason, 2002.

18EC O04

FUNDAMENTALS OF DIGITAL SIGNAL PROCESSING
(OPEN ELECTIVE-II)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Course Objectives: The objectives of this course are

1. Learn the advantages of DSP over analog signal processing.
2. Analyze discrete-time signals in the frequency domain using DFT and FFT.
3. Learn the theory of digital filters.

Course Outcomes: On Successful completion of the course, students will be able to

1. Understand the concept of Discrete time signals and systems
2. Analyze the frequency domain representation of discrete time sequence using DTFT and DFT.
3. Apply FFT to the given sequence.
4. Implementation of FIR filter for the given specifications
5. Design an IIR filter for the given specifications.

UNIT-I

Discrete Time Signals and Systems: Introduction, basic elements of a digital signal processing system, advantages and disadvantages of Digital Signal Processing over Analog signal processing, sampling theorem, analog to digital and digital to analog conversion. Discrete-Time System: Mathematical representation of Discrete Time Systems, Concept of Impulse response and Transfer function, Linear and Time invariant systems, Concept of causality and stability.

UNIT-II

Frequency Domain Analysis of Discrete Time Sequences: Discrete Time Fourier Transform (DTFT), properties of DTFT, Discrete Fourier Transform (DFT) and its properties, relationship between DFT to the DTFT, circular convolution.

UNIT-III

Fast Fourier Transform (FFT): Introduction, Radix-2 Decimation –In- Time (DIT) and Decimation- In-Frequency (DIF) FFT algorithms, Bit reversal order, In-place computation.

UNIT-IV

FIR Filter Design: Characteristics of FIR filters, Linear phase filters, Design of FIR (LPF, HPF, BPF and BSF) filters using Truncation and Windows, Comparison between FIR and IIR filters.

UNIT-V

IIR Filter Design: Characteristics of IIR filters, Conversion from analog filters to digital filters using Impulse Invariance Method (IIM) and Bilinear Transformation (BLT) methods, prewarping. Realization diagrams-Direct form I & II.

Textbooks:

1. Alan V. Oppenheim & Ronald W. Schafer, “Digital Signal Processing,” PHI, 2/e, 2010.
2. John G. Proakis & Dimtris G. Manolakis, “Digital Signal Processing Principles, Algorithms and Application,” PHI, 4/e, 2012.

Suggested Reading:

1. Sanjit K Mitra, " Digital Signal Processing", Tata Mc Graw Hill, Third edition, 2006
2. ChiTsong Chen, "Digital Signal Processing", Indian edition, 2009.

18CE O02

DISASTER MITIGATION AND MANAGEMENT
(OPEN ELECTIVE-II)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Course Objectives: The objectives of this course are to

1. Equip the students with the basic knowledge of hazards, disasters, risks and vulnerabilities.
2. Impart knowledge in students about the nature, causes, consequences and mitigation measures of the various Hydro-meteorological disasters.
3. Introduce the concepts of causes, consequences, and mitigation measures of the various Geographical disasters.
4. Enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters.
5. Equip the students with the knowledge of the impacts of disaster, chronological phases in a disaster management cycle and to create awareness about the disaster management framework and legislations in the context of Central and State Level Authorities.

Course Outcomes: On Successful completion of the course, students will be able to

1. Identify and understand the fundamental terminologies in disaster management.
2. Distinguish between the Hydro-meteorological disasters and apply the concepts of structural and non-structural mitigation measures.
3. Categorize different Geographical Disasters and apply the knowledge in utilizing the early warning systems.
4. Analyze various mechanisms and consequences of human induced disasters.
5. Develop an awareness of disaster management phases and formulating effective disaster management plans, ability to understand various participatory roles of stakeholders- Central and State Government bodies at different levels.

UNIT- I

Introduction: Basic definitions- Hazard, Disaster, Vulnerability, Risk, Resilience, Mitigation, Management; classification of types of disaster- Natural and manmade; Introduction to Disaster management cycle; International Decade for natural disaster reduction (IDNDR); International strategy for disaster reduction (ISDR), National disaster management authority (NDMA).

UNIT- II

Natural Disasters: Hydro meteorological disasters: Causes, Early warning systems- monitoring and management, structural and non-structural measures for floods, drought and Tropical cyclones; Applications. Case studies related to various hydro-meteorological disasters.

UNIT- III

Geographical based disasters: Causes, zoning, Early warning systems- monitoring and management, structural and non-structural mitigation measures for earthquakes, tsunami, landslides, avalanches and forest fires. Case studies related to various geographical based disasters.

UNIT- IV

Human Induced Disasters: Chemical disaster- Causes, impacts and mitigation measures for chemical accidents, Risks and control measures in a chemical industry, chemical disaster management; Case studies related to various chemical industrial hazards eg: Bhopal gas leakage; Management of chemical terrorism disasters and biological disasters; Case studies related to power break downs, fire accidents, traffic accidents, oil spills and stampedes, building failure disasters.

UNIT- V

Concept of Disaster Impacts and Management: Disaster impacts- environmental, physical, social, ecological, economical, political, etc.; health, psycho-social issues; demographic aspects, gender, age, special needs; hazard locations; global and national disaster trends; climate change and urban disasters.

Disaster management cycle and its phases, risk analysis, vulnerability and capacity assessment; Post-disaster environmental response water, sanitation, food safety, waste management, disease control; Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

Textbooks:

1. Pradeep Sahni, "Disaster Risk Reduction in South Asia", Prentice Hall, 2003.
2. B. K. Singh, "Handbook of Disaster Management: Techniques & Guidelines", Rajat Publication, 2008.

Suggested Reading:

1. Ministry of Home Affairs, Government of India, "National Disaster Management Plan, Part I and II",
2. K. K. Ghosh, "Disaster Management", APH Publishing Corporation, 2006.
3. Hazards, Disasters and your community: A booklet for students and the community, Ministry of Home Affairs.
4. Disaster Medical Systems Guidelines, Emergency Medical Services Authority, State of California, EMSA no.214, June 2003.
5. Inter Agency Standing Committee (IASC). IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings, Geneva: IASC. (Feb. 2007)

Online Resources:

1. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs)
2. http://ndma.gov.in/ (Home page of National Disaster Management Authority)

18EGO01

TECHNICAL WRITING SKILLS
(OPEN ELECTIVE-II)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Course Objectives: The objectives of this course are

1. Process of communication and channels of communication in general and technical writing.
2. Technical Writing and also contextual use of technology specific words.
3. Business letters and technical articles.
4. Technical reports and technical proposals.
5. Writing agenda, recording minutes of a meeting, drafting memos and making technical presentations.

Course Outcomes: On Successful completion of the course, students will be able to

1. Understand the channels of communication and define nature and aspects of Technical communication
2. Compare and contrast technical communication to that of general communication while constructing error free sentences applying features of technical writing.
3. Analyze data, draw inferences to write Journal articles and conference papers and to compose business letters.
4. Evaluate data to draft technical reports and technical proposals.
5. Design a technical presentation by understanding the nuances of presentation skills and also prepare agenda and minutes of a meeting.

UNIT - I

Communication – Nature and process.
Channels of Communication – Downward, upward and horizontal and lateral communication. Barriers to communication.
Technical Communication – Definition ; oral and written communication. Importance and need for Technical communication. Nature of Technical Communication. Aspects and forms of Technical communication. Technical communication Skills – Listening, Speaking, Reading & Writing.

UNIT- II

Technical Writing – Techniques of writing. Selection of words and phrases in technical writing. Differences between technical writing and general writing. Abstract and specific words. Sentence structure and requisites of sentence construction. Paragraph length and structure.

UNIT- III

Business correspondence – Sales letters, letters of Quotation, Claim and Adjustment letters.
Technical Articles: Nature significance and types of technical articles. Writing an abstract. Journal articles and Conference papers. Elements of technical articles.

UNIT- IV

Technical Reports: Types, significance, structure, style and writing of reports. Routine reports, Project reports.
Technical Proposals: Definition, types, characteristics, structure and significance.

UNIT- V

Mechanics of Meetings: Information Transfer – Graphic to verbal(written) and verbal to graphic.
Technical Presentations: Important aspects of oral and visual presentations.

Textbooks:

1. Meenakshi Raman & Sangeeta Sharma, “Technical Communications-Principles and Practice”, Oxford University Press, Second Edition, 2012.
2. 1.M Ashraf Rizvi, “Effective Technical Communication”, Tata McGraw Hill Education Pvt Ltd, 2012.

Suggested Reading :

1. Kavita Tyagi & Padma Misra, “Basic Technical Communication”, PHI Learning Pvt Ltd, 2012.

2. R.C Sharma & Krishna Mohan, “Business Correspondence and Report Writing”, Tata McGraw Hill, 2003

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc18_mg13/preview
2. https://www.technical-writing-training-and-certification.com/
3. https://academy.whatfix.com/technical-writing-skills

18CSE26

DATA SCIENCE AND BIG DATA ANALYTICS LAB
(PROFESSIONAL ELECTIVE-IV LAB)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	25 Marks
Credits	1.5

Course Objectives: The objectives of this course are to

1. Develop the skills in using data science tools for solving data intensive problems.
2. Explore the fundamental concepts of big data analytics.
3. Understand the applications using Map Reduce Concepts.

Course Outcomes: On Successful completion of the course, students will be able to

1. Implement and apply data science algorithms to solve problems.
2. Implement various the exploratory data analysis techniques to understand the data.
3. Work with big data platform and explore the big data analytics techniques business applications.
4. Design efficient algorithms for analyzing the data from large volumes.
5. Analyze the HADOOP and Map Reduce technologies associated with big data analytics.

LIST OF EXPERIMENTS:

1. Identification and Installation of required softwares/Technologies (python/modules) (Important modules for statistical methods: Numpy, Scipy, Pandas etc.).
2. Demonstration of Inferential Statistics-sampling, Hypothesis testing-Z/t tests.
3. Demonstration of statistical methods Anova, Correlation and Chi-square. (Important modules for Machine Learning:(ScikitLearn,statsmodels,scipy, NLTK etc.).
4. Demonstration of Sentiment analysis using NLTK.
5. Time Series Forecasting with ARIMA model.
6. Installation of Big data technologies and building a Hadoop cluster.
7. Experiment for data loading from local machine to Hadoop.
8. Demonstration of Map Reduce concept.
9. Experiment for loading data from RDBMS to HDFS by using SQOOP.
10. Demonstration of developing and handling a NOSQL database with HBase.

Textbooks / Suggested Reading:

1. Tom White, “Hadoop: The Definitive Guide: Storage and Analysis at Internet Scale”, 4th Edition, O'Reilly Publications, 2015.
2. Samir Madhavan, “Mastering Python for Data Science”, Packt Publishing, 2015.
3. Seema Acharya, SubhasininChellappan, “Big Data and Analytics”, Wiley publications.
4. Big Data, Black BookTM, DreamTech Press, 2015 Edition

18CSE27

MACHINE LEARNING LAB
(PROFESSIONAL ELECTIVE-IV LAB)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	25 Marks
Credits	1.5

Prerequisites: Basics of python programming

Course Objectives: The main objectives of this course are

1. Make use of Data sets in implementing the machine learning algorithms.
2. Implement the machine learning concepts and algorithms in any suitable language of choice.
3. Make use of real-world data to implement machine learning models.

Course Outcomes: On Successful completion of the course, students will be able to

1. Identify the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.
2. Identify and utilize modern tools that are useful for data analysis
3. Recognize and implement various ways of selecting suitable model parameters for different machine learning techniques.
4. Implement and evaluate various Machine Learning approaches
5. Apply Keras and Tensorflow to implement ML techniques
6. Design and develop solutions to real world problems using ML techniques

LIST OF EXPERIMENTS:

1. Identification and Installation of python environment towards the machine learning, installing python modules/Packages Import scikitlearn, keras and tensorflows etc.
2. Demonstration of decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a newsample.
3. Build linear regression model using gradient descent, least squares, polynomial, LASSO and RIDGE approaches also compare all the algorithms and draw a table for all the metrics.
4. Demonstration of Naïve Bayesian classifier for a sample training data set stored as a .CSV file. Calculate the accuracy, precision, and recall for your dataset.
5. Demonstration of Logistic Regression for a sample training data set stored as a .CSV file. Calculate the accuracy, precision, and recall for your dataset.
6. Demonstration of Clustering algorithms - k-Means, K-Nearest Neighbor a, Agglomerative and DBSCAN to classify for the standard datasets. Print both correct and wrong predictions using Java/Python ML library classes can be used for this problem.
7. Experiment the non-parametric locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graph
8. Demonstration of SVM and use for character recognition task.
9. Build the decision tree classifier compare its performance with ensemble techniques like random forest. Demonstrate it with different decision trees.
10. Case study on supervised learning algorithms.

Textbooks:

1. Giuseppe Bonaccorso, “Machine Learning Algorithms”,2017, Packt Publishing.

18CSE28

VIRTUAL REALITY LAB
(PROFESSIONAL ELECTIVE-IV LAB)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	25 Marks
Credits	1.5

Course Objectives: The objectives of this course are

1. Understand the hardware and software requirements of Virtual Reality.
2. Design and implement solutions for simple real-world problems.
3. Simulate Virtual Reality based solutions for the complex problems.

Course Outcomes: On Successful completion of the course, students will be able to

1. Analyse the Hardware and Software requirements for Virtual Reality
2. Apply Virtual Reality based technologies to create virtual components.
3. Design solutions for the simple real world problems.
4. Implement solutions for the simple world problems.
5. Evaluate the benefits and drawbacks of specific VR techniques on the human body.
6. Develop Virtual Reality based solutions for complex real world problems.

LIST OF EXPERIMENTS:

1. Developing architecture of a house using Virtual Reality.
2. Perform CRO based experiment using Virtual Reality.
3. Understanding qualitative analysis of Chemistry using Virtual Reality.
4. Carry out assembly/disassembly of an engine using Virtual Reality.
5. Explore human anatomy using Virtual Reality.
6. Simulation of blood circulation in heart.
7. Simulation of Flight/Vehicle/Space Station.
8. Building Electronic circuit using Virtual Reality, given basic electronic circuits.
9. Developing concept of Virtual Reality class room with multiplier.

Textbooks:

1. JohnVince,“VirtualRealitySystems”,PearsonEducationAsia,2007.
2. K. S. Hale and K. M. Stanney, Handbook on Virtual Environments, 2nd edition, CRC Press, 2015.
3. Steve M Lavalle, “Virtual Reality”, Cambridge University Press, 2017

Online Resources:

1. www.vresources.org
2. www.vrac.iastate.edu
3. www.w3.org/MarkUp/VRM

18CSE29

CYBER SECURITY LAB
(PROFESSIONAL ELECTIVE-IV LAB)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	25 Marks
Credits	1.5

Pre-requisites: Operating System, Computer Network, Cryptography.

Course Objectives: The objectives of this course are to

1. To know the security vulnerabilities of browsers and Web Application.
2. To identify the threats and the file infected by Virus and indicators for the cybercrime and to deal with all aspects of cyber laws in Email Communication and E-commerce services.
3. To understand the characteristics of any target network and to monitor and troubleshoot network traffic.

Course Outcomes: On Successful completion of the course, students will be able to

1. Understand the security and privacy features and operation of browsers and websites.
2. Understand the security issues and vulnerability in Email system E-commerce services.
3. Point out the vulnerabilities in TCP/IP Protocols used for communications.
4. Analyze the Network Traffic for any security issues and performing the steps for the identification of Virus.
5. Discuss different types of cybercrimes and describe the laws governing cyberspace.

List of Experiments:

1. Steps to ensure Security of any one web browser (Mozilla Firefox/Google Chrome)
2. Study of different types of vulnerabilities for hacking a websites / Web Applications.
3. Analysis the Security Vulnerabilities of E-commerce services.
4. Analysis the security vulnerabilities of E-Mail Application
5. Port scanning using NMAP
6. Analyze the Network Traffic using Wire shark.
7. Collect the owner's private information using Key logger (Spyware)
8. Identification of Virus infected file using virustotal.com
9. Case Study on Indian IT ACT 2000.
10. Case Study on Cyber Attack/ Cyber Crime.

Textbooks:

1. Sunit Belpre and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives", Wiley India Pvt,Ltd,2011.
2. Alfred Basta, Nadine Basta, Mary Brown, Ravinder Kumar, "Cyber Security and Cyber Laws", Paperback – 2018.

Online Resources:

1. http://kundanit.blogspot.com/p/cyber-security.html

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)

SCHEME OF INSTRUCTION AND EXAMINATION

Model Curriculum

B.E. (Computer Science and Engineering)

SEMESTER –VIII

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	18CSE 30/31/32/33	Professional Elective-VI	3	0	0	3	30	70	3
2	18XX O XX	Open Elective-III	3	0	0	3	30	70	3
PRACTICAL									
3	18CSC31	Technical Seminar	0	0	3	-	50	-	1
4	18CSC32	Project: PART-2	0	0	20	-	100	100	10
		TOTAL	**6**	**0**	**23**		**210**	**240**	**17**

L: Lecture T: Tutorial D: Drawing P: Practical

CIE - Continuous Internal Evaluation SEE - Semester End Exam

PROFESSIONAL ELECTIVE-VI	
Course Code	**Title of the Course**
18CSE30	Bioinformatics
18CSE31	Speech and Natural Language Processing
18CSE32	Social Networking and its Impact
18CSE33	Blockchain Technology

OPEN ELECTIVE-III	
Course Code	**Title of the Course**
18PYO01	History of Science and Technology
18MEO01	Robotics
18MEO03	Research Methodologies
18MEO04	Entrepreneurship
18MEO12	3D Printing

18CSC31

TECHNICAL SEMINAR

Instruction	3 Hours per week
Duration of End Examination	-
Semester End Examination	-
Continuous Internal Evaluation	50 Marks
Credits	1

The goal of a seminar is to introduce students to critical reading, understanding, summarizing, explaining and preparing report on state of the art topics in a broad area of his/her specialization. Seminar topics may be chosen by the students with advice from the faculty members and the student shall read further relevant articles in the domain.

The seminar must be clearly structured and the power point presentation shall include following aspects:

1. Introduction to the field
2. Literature survey
3. Consolidation of available information
4. Summary and Conclusions
5. References

Each student is required to:

1. Submit a one page synopsis of the seminar talk for display on the notice board.
2. Deliver the seminar for a maximum duration of 30 minutes, where the presentation should be for 20 minutes in PowerPoint, followed by Question and Answers session for 10 minutes.
3. Submit the detailed report of the seminar in spiral bound in a précised format as suggested by the department.

Seminars are to be scheduled from 3rd week to the last week of the semester and any change in schedule shall be discouraged.

For the award of sessional marks students are judged by three (3) faculty members and are based on oral and written presentations as well as their involvement in the discussions during the oral presentation.

Note: Topic of the seminar shall preferably be from any peer reviewed recent journal publications.

Guidelines for awarding marks		
Sl No.	Description	Max Marks
1.	Contents and relevance	10
2.	Presentation skills	10
3.	Preparation of PPT slides	05
4.	Questions and answers	05
5.	Report in a prescribed format	20

18CSC32

PROJECT: PART-2

Instruction	20 Hours per week
Duration of End Examination	-
Semester End Examination	100 Marks
Continuous Internal Evaluation	100 Marks
Credits	10

The object of 'Project: Part-2' is to enable the student extend further the investigative study taken up, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modeling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/ Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar presentation before Department Review Committee.

Guidelines for the award of marks in CIE: (Max. Marks: 100)

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
Department Review Committee	10	Review 1
	15	Review 2
	25	Submission
Supervisor	10	Regularity and Punctuality
	10	Work Progress
	10	Quality of the work which may lead to publications
	10	Report Preparation
	10	Analytical / Programming / Experimental Skills

Guidelines for awarding marks in SEE: (Max. Marks: 100)

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
External and Internal Examiners together	20	Power Point Presentation
	40	Thesis Evaluation
	20	Quality of the project • Innovations • Applications • Live Research Projects • Scope for future study • Application to society
	20	Viva-Voce

18CSE30

BIOINFORMATICS
(PROFESSIONAL ELECTIVE-VI)

Instructions	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Pre-requisites: Basic of Biology, Computer Networks, Database Management Systems.

Course Objectives: The objectives of this course are

1. Understand the basic concepts, search and visualize information.
2. Learn various bioinformatics algorithms.
3. Understand various data mining and pattern matching techniques.

Course Outcomes: On Successful completion of the course, students will be able to

1. Identify the basics concepts of Bioinformatics and its significance in Biological data analysis**.**
2. Explore the basic algorithms used in pair wise alignment and multiple sequence alignment.
3. Apply various Bioinformatics tools and techniques employed in Biological Sequence Analysis.
4. Analyze computational experiments for training and evaluating machine learning methods such as EM/GEM, HMM, Monte Carlo
5. Choose and apply appropriate data mining methods like classification, clustering for solving complex biological problems.
6. Interpret the algorithms and tools used for simulation in biological processes and in analysis of biological data

UNIT – I

Introduction to bioinformatics Introduction, historical overview, definition, applications, major databases, data management & analysis, molecular biology & bioinformatics.

Information search & data retrieval: Introduction, tools for web search, data retrieval tools and data mining of biological databases.

UNIT - II

Pair-wise Sequence Alignment: Introduction, alignment problems, methods of sequence alignments, using scoring matrices & measuring sequence detection efficiency.

Multiple Sequence Alignment: Introduction, methods of multiple sequence alignment, evaluating multiple alignments, applications of multiple sequence alignment & phylogenetic analysis.

UNIT - III

Tools for similarity searches & sequence alignment: Introduction, working with BLAST, working with FASTA, Filtering and gapped BLAST, FASTA and BLAST algorithms comparison.

Protein Structure Prediction & Visualization: Protein Secondary Structure Prediction, Protein Tertiary Structure Prediction, Prediction of Protein Function, Evaluation of Predicted Structure, Visualization Tools: Rasmol, RasTop&spdbv.

UNIT - IV

Machine Learning in Bioinformatics :EM/ GEM algorithms, Markov chain Monte Carlo methods, simulated annealing.

Hidden Markov Models: Introduction, likelihood & Basic algorithms, Learning algorithms, Protein Applications, Advantages and Limitations of HMM.

UNIT - V

Data Mining- Selection and Sampling, Pre-processing and Cleaning, Transformation and Reduction, Data Mining Methods, Evaluation, Visualization, Designing new queries, Pattern Recognition and Discovery, Text Mining , Tools.

Textbooks:

1. Rastogi. S. C, Mendiratta. N and Rastogi. P. " Bioinformatics Methods and Applications: Genomics, Proteomics and Drug Discovery" , Prentice-Hall of India Pvt. Ltd.3rd edition.
2. SørenBrunak, Pierre F Baldi, "Bioinformatics: The Machine Learning approach", MIT Press, 2001.

Suggested Reading:

1. Bryan Bergeron, "Bio Informatics Computing", 2ndEdition, Pearson Education, 2015.
2. Teresa K. Attwood and David J. Parry – Smith. "Introduction to Bioinformatics. Pearson education" , Singapore 2005.
3. JinXiong, "Essential Bio Informatics", Cambridge University Press, 2006.

Online Resources:

1. https://nptel.ac.in/courses/102106065/
2. https://www.ncbi.nlm.nih.gov/

18CSE31

SPEECH AND NATURAL LANGUAGE PROCESSING
(PROFESSIONAL ELECTIVE-VI)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Pre-requisites: Artificial Intelligence, Compiler Construction

Course Objectives: The objectives of this course are

1. To learn the fundamentals of natural language processing.
2. To understand the various Parsing techniques NLP.
3. To understand the role of semantics of sentences and pragmatics and apply the NLP techniques to IR applications.

Course Outcomes: On Successful completion of the course, students will be able to

1. Define the basic concepts of speech sound, phonetics, signals origins and applications of Natural Language processing.
2. Discuss about the language modeling techniques.
3. Identify the basic words, parsers and various levels in processing of natural language.
4. Explain the various semantics discourse and pragmatic levels of NLP.
5. Analyze Natural language Generation and apply machine translation.
6. Implement levels of NLP system using lexical resources to demonstrate Morphology of a language.

UNIT - I

Speech: Phonetics Speech Sounds and Phonetic Transcription. Articulator Phonetics Phonological categories and Pronunciation Variation Acoustic phonetics and signals. Automatic Speech Recognition Architecture. **Overview and Language Modeling:** OVERVIEW: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages-NLP Applications-Information Retrieval.

UNIT - II

Language Modeling: Introduction-Various Grammar-based Language Models-Statistical Language Model. **Word Level Analysis**: Introduction Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. PARSING: Constituency Parsing-Probabilistic Parsing.

UNIT - III

Semantic Analysis: Introduction- Meaning Representation-Lexical Semantics Ambiguity-Word Sense Disambiguation. **Discourse Processing:** Introduction- cohesion-Reference Resolution Discourse Coherence and Structure.

UNIT - IV

Natural Language Generation and Machine Translation: Architecture of NLG Systems Generation Tasks and Representations-Application of NLG. Problems in Machine, Translation, Characteristics of Indian Languages- Machine Translation Approaches-Translation involving Indian Languages.

UNIT - V

Applications and Lexical Resources: Information Extraction, Automatic Text Categorization and Text Summarization, Question-Answering System.

Textbooks:

1. Daniel Jurafsky and James H Martin, “Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition”, Prentice Hall, 2nd Edition, 2008.
2. Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.

Suggested Reading:

1. James Allen, Bejamin/ cummings, “Natural Language Understanding”, 2nd edition, 1995.

Online Resources:

1. https://nptel.ac.in/courses/106101007/
2. http://www.cs.colorado.edu/~martin/sp2.html
3. https://web.standford.edu/~jurafsky/sp3/

18CSE32

SOCIAL NETWORKING AND ITS IMPACT
(PROFESSIONAL ELECTIVE-VI)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Pre-requisites: Data Structure, Computer Networks, Web and Internet Technologies (Optional)

Course Objectives: The objectives of this course are

1. Familiarize the students with social networks and their representation.
2. Understand the impact of social networks on society.
3. Study and Analyze the social network search models.

Course Outcomes: On Successful completion of the course, students will be able to

1. Identify the significance of social networks, representation, ranking techniques and challenges.
2. Understand a broad range of social networks concepts and theories.
3. Ascertain the network analysis knowledge in a diversified aspect of society.
4. Analyze social network links and web search.
5. Differentiate between centralized and decentralized search models.
6. Generate and Communicate the analysis results and impact of social networks.

UNIT - I

Introduction: to Social Networks: Introduction to Social Networks, Challenges, Google page rank, Searching on network, link prediction, contagious, marketing on social networks.

Graphs: Basic definitions, paths and connectivity, distance and breadth first search, network datasets. **Strong and Weak Ties**: Triadic closure, strength of weak Ties, Tie strength and network structure in large-scale data, Tie strength, social media and passive engagement, closure, structured holes and social capital.

UNIT - II

Networks in surrounding contexts: Homophily, selection and social influence, affiliation, tracking link formation in online data, spatial model of segregation. **Positive and negative relationships**: Structural balance, characterizing the structure of balanced networks, applications of structured balance.

UNIT - III

Link analysis and Web search: Searching the web, ranking, link analysis using hubs and authorities, page rank, link analysis in modern web search, applications beyond web.

Cascading behavior in networks: Diffusion in networks, modeling diffusion, cascades and clusters, diffusion, thresholds and role of weak Ties, extensions of cascade model, knowledge, thresholds and collective actions.

UNIT - IV

Power Laws and Rich-get-Richer Phenomena: Popularity as a network phenomenon, power laws, rich-get-richer models, unpredictability of rich-get-richer effects, effects of search tools and recommender systems, analysis of rich-get-richer processes. Pseudo core- how to go viral on the web.

UNIT - V

Small world phenomenon: Six degrees of separation, structured and randomness, decentralized search, modeling the process of decentralization search, empirical analysis and generalized models, core-peiphery structures and difficulties in decentralized search, analysis of decentralized search.

Textbooks:

1. David Eas ley, Jon Kleinberg, “Networks, Crowds and Markets”, Cambridge Press, 2010 (available for free download).
2. Mathew O Jackson “Social and Economic Networks”, Princeton University, 2010.

Suggested Reading:

1. Stephen P Borgatti, Martin G. Everett , Jeffrey C. Johnson, "Analyzing Social Networks", 2018, Second edition, SAGE Publications Ltd.

2. Krishna Raj P.M., Ankith Mohan, K.G. Srinivasa, "Practical Social Network Analysis with Python", Computer Communications and Networks, Springer; 1st ed. 2018 edition, ISBN-10: 9783319967455.

Online Resources:

1. https://nptel.ac.in/downloads/106106169/

18CSE33

BLOCKCHAIN TECHNOLOGY
(PROFESSIONAL ELECTIVE-VI)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Pre-requisites: Computer Networks, Network Security

Course Objectives: The objectives of this course are
1. Understand the basic concepts and architecture of block chain.
2. Interpret working of Hyper ledger Fabric.
3. Applications of block chain in various domains.

Course Outcomes: On Successful completion of the course, students will be able to
1. State the basic concepts and design primitives of blockchain.
2. Understand the significance of Consensus mechanisms.
3. Interpret the working of Hyperledger Fabric, SDK composer tool.
4. Demonstrate the significance of blockchain in financial, supply chain and government sector based use cases.
5. Analyze the need of blockchain mechanisms in Cryptography.

UNIT – I
Introduction: History: Digital Money to Distributed Ledgers ,Design Primitives: Protocols, Security, Blockchain Architecture and Design, Hashing, Signature-Hash chain to Blockchain.

UNIT – II
Consensus: Significance of Consensus, Requirements for the consensus protocols-Proof of Work (PoW)-Scalability aspects of Blockchain consensus protocols**:** Permissioned Blockchains-Design goals, Consensus protocols for Permissioned Blockchains.

UNIT - III
Hyperledger Fabric: Hyperledger fabric components-Chaincode Design and Implementation: Hyperledger Fabric II:- Beyond Chaincode: fabric SDK and Front End-Hyperledger composer tool.

UNIT - IV
Use Case I: Blockchain in Financial Software and Systems (FSS): Settlements, KYC, Capital markets-Insurance.
Use case II: Blockchain in trade/supply chain, invoice management/discounting.

UNIT - V
Use Case III: Block chain for Government: Digital identity, land records, Block chain Cryptography : Privacy and Security on Block chain.

Textbooks:
1. Mark Gates, "Block chain: Ultimate guide to understanding block chain, bit coin, crypto currencies, smart contracts and the future of money", Wise Fox Publishing and Mark Gates, 2017.
2. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O'Dowd, Venkatraman Ramakrishna, "Hands-On Blockchain with Hyperledger: Building decentralized applications with Hyperledger Fabric and Composer", 2018.
3. Arshdeep Bahga, Vijay Madisetti, "Blockchain Applications: A Hands- On Approach", Arshdeep Bahga, Vijay Madisetti publishers 2017.

Suggested Reading:
1. Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly, 2014.
2. Melanie Swa, "Blockchain ",O'Reilly Media, 2014.

Online Resources:

1. Blockchain Applications- https://www.blockchain-books.com
2. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric
2. Zero to Blockchain - An IBM Redbooks course, by Bob Dill, DavidSmits, 2017. (https://www.redbooks.ibm.com/Redbooks.nsf/ Redbook Abstracts/crse0401.html)
3. https://onlinecourses.nptel.ac.in/noc18_cs47/preview
4. https://www.udemy.com/blockchain-and-bitcoin-fundamentals/

18PYO01

HISTORY OF SCIENCE AND TECHNOLOGY
(OPEN ELECTIVE-III)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Course Objectives: The objectives of this course are

1. Gains the knowledge about origin of science in the Stone Age and its progress during Antiquity period.
2. Familiar with scientific views in the Medieval period and during the Industrial revolution.
3. Aware of modern scientific developments from 19th century onwards.

Course Outcomes: On Successful completion of the course, students will be able to

1. Demonstrate the process of beginning of science and civilization, knowledge acquisition and philosophical approach of science and its advancements in the Stone Ages and Antiquity period.
2. Illustrate the advancements in science and technology in the medieval period across Asia and Arab countries and decline and revival of science in Europe.
3. Explain the scientific approach and its advances of the Europeans and how the role of engineer during the industrial revolution and the major advancements.
4. Make use of the advancements in the field of science and technology by adopting new philosophies of 19th and first half of 20th century in finding ethical solutions to the societal problems.
5. Interpret the changes in specializations of science and the technology and build the relation between information and society from second half of 20th century onwards.

UNIT - I

Science - The Beginning (through 599 BCE): The Stone Ages, Knowledge among hunter gatherers, Agricultural Revolution and other revolutions, Civilization, Major advances.

Science in Antiquity (600 BCE- 529 CE): Philosophy- a precursor to science, Hellenistic world and the Roman Empire, Other cultures of the period, Major advances.

UNIT - II

Medieval Science (530 CE - 1452 CE): The decline of science in Europe, Science in China, Science and mathematics in India, Arab science, Revival of science in Europe, Technology revolution of the Middle ages, Major advances.

The Renaissance and the Scientific Revolution (1453 CE – 1659 CE): Renaissance, Scientific Revolution, Technology, Major advances.

UNIT - III

Scientific Method: Measurement and Communication (1660 CE – 1734 CE): European domination, The scientific method, Major advances.

The Industrial Revolution (1735 CE – 1819 CE): Industrial Revolution, Rise of the engineer, Major Advances.

UNIT - IV

Science and Technology in the 19th Century (1820 CE – 1894 CE): Philosophical basis of 19th-century science, Science and the public, Science and technology, Major advances.

Rise of Modern Science and Technology (1895 CE – 1945 CE): The growth of 20thcentury science, New philosophies, Quantum reality, Energy sources, Electricity: a revolution in technology, Major advances.

UNIT - V

Big Science and the Post-Industrial Society (1946 CE – 1972 CE): Big science, Specialization and changing categories, Technology changes society, Major advances.

The Information Age (1973 CE – 2015 CE): Information and society, Globalization, The post-industrial society, Problems of the Information age, Major Advances

Textbooks:

1. Bryan Bunch and Alexander Hellemans, “The History of Science and Technology”, Houghton Mifflin Company (New York), 2004.

2. JD Bernal, “Science in History”, 4 Volumes, Eklavya Publishers, 2012.

Suggested Readings:

1. “The 100 Most Influential Scientists of All Time”, Edited by Kara Rogers, Britannica Educational Publishing, 2010.
2. Alberto Hernandez, “A Visual History of Science and Technology”, The Rosen Publishing Group, 2016.

18MEO01

ROBOTICS
(OPEN ELECTIVE-III)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Course Objectives: The objectives of this course are

1. Principle of working of a robot, types and specifications, configuration, work envelop and motion controls and applications.
2. Transformations, kinematics and dynamics of robots.
3. Singularities, Jacobian and trajectory planning of a robot to prepare the robot for various tasks.
4. Design of end effectors, drives, working of sensors and controllers for finding position and orientation.
5. Robot vision for image acquisition and processing and plan for various tasks and various Languages and Programming methods of robot.

Course Outcomes: On Successful completion of the course, students will be able to

1. Describe the basic components, specifications and applications of the robots.
2. Understand transformations, direct and inverse kinematics of robots.
3. Calculate forces in links and joints of a robot and find the singularities, Jacobian and trajectory planning of a robot for various tasks.
4. Classify drives, sensors and grippers for various applications.
5. Program a robot to predict motions for a given task with machine vision and sensors.

UNIT - I

Introduction to robotics: History and evolution of robots, basic configuration, degree of freedom, work envelope, motion control methods, various applications in industry, material handling, loading & unloading, processing, welding & painting, assembly, and inspection, requirements and specifications of robots.

UNIT - II

Rigid motions and homogeneous transformations: Rotation matrix, homogenous transformation matrix, Denavit- Hartenberg convention, Euler angles, RPY representation, direct and inverse kinematics for industrial robots for position and orientation.

UNIT - III

Velocity kinematics – the manipulator Jacobian: joint, end effect or velocity, direct and inverse velocity analysis. **Trajectory planning:** Interpolation, cubic polynomial, linear segments with parabolic blending, static force and moment transformation, solvability, stiffness, singularities.

UNIT - IV

Robot dynamics: Lagrangian Formulation for link inertia tensor and manipulator inertia tensor, Newton-Euler formulation for RR & RP manipulators. **Control:** Individual, joint and computed torque.

UNIT - V

End effectors**:** Position and velocity measurement. **Sensors:** Proximity and range, tactile, force and torque, **Drives for Robots:** Electrical, Hydraulic and Pneumatic. **Robot vision:** Introduction to technique, image acquisition and processing, introduction to robot programming languages.

Textbooks:

1. Spong and Vidyasagar, “Robot Dynamics and Control”, John Wile and Sons,1990.
2. R.K. Mittal, I.J. Nagrath, “Robotics and control”, Tata Mcgraw-Hill Publishing Company Ltd., 2003.
3. Groover, “Industrial Robotics”, Mcgraw-Hill Publishing Company Ltd.2003.

Suggested Reading:

1. Asada and Slotine, “Robot analysis and Intelligence”, Wiley Interscience, 1986.
2. K.S. Fu GonZalezRC., lEEc.S.G.,“Robotics, Control Sensing Vision and Intelligence”, McGraw Hill, Int.ed,1987.

18MEO03

RESEARCH METHODOLOGIES
(OPEN ELECTIVE-III)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Course Objectives: The objectives of this course are

1. To make the students to formulate the research problem.
2. To identify various sources for literature review and data collection.
3. To prepare the research design.
4. To equip the students with good methods to analyze the collected data.
5. To explain how to interpret the results and report writing.

Course Outcomes: On Successful completion of the course, students will be able to

1. Define research problem.
2. Review and assess the quality of literature from various sources.
3. Understand and develop various research designs.
4. Analyze problem by statistical techniques: ANOVA,F-test, Chi-square.
5. Improve the style and format of writing a report for technical paper/Journal report.

UNIT – I

Research methodology: Objectives and motivation of research, types of research- descriptive vs. analytical, applied vs. fundamental, quantitative vs. qualitative, conceptual vs. empirical, research approaches, significance of research, research methods vs. methodology, research process, criteria of good research, problems encountered by researchers in India, technique involved in defining a problem.

UNIT – II

Literature survey: Importance of literature survey, sources of information-primary, secondary, tertiary, assessment of quality of journals and articles, information through internet.

UNIT – III

Research design: Meaning of research design, need of research design, feature of a good design important concepts related to research design, different research designs, basic principles of experimental design, steps in sample design.

UNIT – IV

Data collection: Collection of primary data, Secondary data, measures of central tendency-mean, mode, median, measures of dispersion- range, mean deviation, standard deviation, measures of asymmetry (skewness), important parametric tests -z, t, F, Chi-Square, ANOVA significance.

UNIT – V

Research report formulation and presentation: Synopsis, dissertation, technical paper and journal paper, writing research grant proposal, making presentation with the use of visual aids, writing a proposal for research grant.

Textbooks:

1. C.R Kothari, “Research Methodology Methods & Technique”, New Age International Publishers, 2004.
2. R. Ganesan, “Research Methodology for Engineers”, MJP Publishers,2011.
3. Vijay Upagade and Aravind Shende, “Research Methodology”, S. Chand &Company Ltd., New Delhi,2009.

Suggested Reading:

1. G. Nageswara Rao, “Research Methodology and Quantitative methods”, BS Publications, Hyderabad, 2012.
2. Naval Bajjai, “Business Research Methods”, Pearson Education,2011.

18MEO04

ENTREPRENEURSHIP
(OPEN ELECTIVE-III)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Course Objectives: The objectives of this course are

1. Concept and procedure of idea generation.
2. The nature of industry and related opportunities and challenges.
3. Elements of business plan and its procedure.
4. Project management and its techniques.
5. Behavioral issues and Time management.

Course Outcomes: On Successful completion of the course, students will be able to

1. Understand the concept and essence of entrepreneurship.
2. Identify business opportunities and nature of enterprise.
3. Analyze the feasibility of new business plan.
4. Apply project management techniques like PERT and CPM for effective planning and execution of projects.
5. Use behavioral, leadership and time management aspects in entrepreneurial journey.

UNIT - I

Entrepreneurship: Definition, functions of entrepreneurship, qualities of entrepreneurs, identification and characteristics of entrepreneurs, entrepreneur vs. intrapreneur, first generation entrepreneurs, women entrepreneurs, conception and evaluation of ideas and their sources.

UNIT - II

Indian industrial environment: Competence, opportunities and challenges, entrepreneurship and economic growth, small scale industry in India, objectives, linkage among small, medium and heavy industries, types of enterprises, corporate social responsibility.

UNIT - III

Business plan: Introduction, elements of business plan and its salient features, business model canvas, technical analysis, profitability and financial analysis, marketing analysis, feasibility studies, executive summary, selection of technology and collaborative interactions.

UNIT - IV

Project management: During construction phase, project organization, project planning and control using CPM, PERT techniques, human aspects of project management, assessment of tax burden.

UNIT - V

Behavioural aspects of entrepreneurs: Personality, determinants, attributes and models, leadership concepts and models, values and attitudes, motivation aspects, time management: approaches of time management, their strengths and weaknesses. time management matrix and the urgency addiction, measures of asymmetry (skewness), important parametric tests -z, t, F, Chi-Square, ANOVA significance.

Textbooks:

1. Vasant Desai, “Dynamics of Entrepreneurial Development and Management”, Himalaya Publishing House, 1997.
2. Prasanna Chandra, “Project-Planning, Analysis, Selection, Implementation and Review”, Tata Mcgraw-Hill Publishing Company Ltd.1995.
3. S.S. Khanka, “Entrepreneurial Development”, S. Chand & Co. Pvt. Ltd., New Delhi,2015.

Suggested Reading:

1. Robert D. Hisrich, Michael P. Peters, “Entrepreneurship”, 5/e, Tata Me Graw Hill Publishing Company Ltd., 2005.
2. Stephen R. Covey and A. Roger Merrill, “First Things First”, Simon and Schuster Publication,1994.

18MEO12

3D PRINTING
(OPEN ELECTIVE-III)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Course Objectives: The objectives of this course are

1. To make students understand the basic concept of digital manufacturing.
2. To teach different processes involved in digital fabrication of products.
3. To demonstrate the STL file generation and manipulations.
4. To demonstrate various post processing techniques.
5. To demonstrate the applications of RP in different fields of engineering.

Course Outcomes: On Successful completion of the course, students will be able to

1. Understand the concept of 3D printing processes, advantages and limitations.
2. Evaluate real-life scenarios and recommend the appropriate 3D printing technology.
3. Analyze various pre-processing and post processing techniques.
4. Explain current and emerging 3D printing technologies in diversified applications.
5. Identify components required in construction of 3D printer.

UNIT - I

Introduction to 3D Printing: Introduction to 3D printing, evolution, distinction between 3D printing & CNC machining. **Design considerations:** Materials, size, resolution, mass customization. additive vs. subtractive manufacturing, its advantages and limitations.

UNIT - II

Photo polymerization processes: Photo polymerization, Stereo lithography Apparatus (SLA), Applications, advantages and disadvantages. **Powder bed fusion processes:** Introduction, Selective laser Sintering (SLS), Materials, Applications, advantages and disadvantages.
Extrusion-based systems: Fused deposition modelling (FDM), laminated object manufacturing (LOM), Principles, Materials, Process Benefits and Drawbacks. **Material Jetting AM Processes:** Evolution of Printing as an Additive Manufacturing Process, Materials, Process Benefits and Drawbacks, Applications of Material Jetting Processes.

UNIT - III

Pre processing in AM: Modelling and viewing - 3D scanning; Model preparation – STL conversion, STL error diagnostics, STL file Repairs, generic solution, slicing, newlyproposed file formats.
Post processing in AM: Support material removal, surface texture improvement, accuracy improvement, aesthetic improvement, preparation for use as a pattern, property enhancements using non–thermal and thermal techniques.

UNIT - IV

Construction of basic 3D printer: Construction of 3D printing machine – axes, linear motion guide ways, ball screws, motors, bearings, encoders, process chamber, safety interlocks, sensors.

UNIT - V

Applications of AM: Application in aerospace industry, automotive industry, jewelry industry, coin industry. medical and bioengineering applications: planning and simulation of complex surgery, forensic science.

Textbooks:

1. Gibson, DW. Rosen and B.Stucker; "Additive manufacturing methodologies : Rapid prototyping to direct digital manufacturing ", Springer,2010.
2. Chee Kai Chua, Kah Fai Leong, "3D printing and additive manufacturing: principles and application", 4/e of rapid proto typing, World scientific publishing company, 2014.
3. P.K. Venuvinod, "Rapid prototyping – Laser based and other technologies", Kluwer,2004.

Suggested Reading:

1. Jacob, Paul, “Rapid tooling : Technologies and industrial applications”, Taylor & Francis Group , 2000.
2. Alain Bernard, Georges Taillandier, “Additive Manufacturing”, Wiley, 2014.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
(MODEL CURRICULUM)

OPEN ELECTIVE FOR OTHER PROGRAMME

S.NO.	SUBJECT CODE	SUBJECT NAME
1	18CSO 01	Python for Bioinformatics
2	18CSO 02	JAVA Programming and Bio-Java
3	18CSO 03	IOT and Applications
4	18CSO 04	Basics of Data Science using R
5	18CSO 05	Fundamentals of Virtual Reality
6	18CSO 06	Fundamentals of DBMS
7	18CSO 07	Basics of Cyber Security
8	18CSO 08	Open Source Technologies
9	18CSO 09	Basics of Artificial Intelligence
10	18CSO 10	Machine Learning Using Python
11	18CSO 11	Computer Graphics and Its Applications
12	18CSO 12	Fundamentals of Software Engineering
13	18CSO 13	Fundamentals of Blockchain Technology

18CSO 01

PYTHON FOR BIOINFORMATICS

(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Course Objectives: The main objectives of this course are

1. Introduce Python with reference to bioinformatics.
2. Understanding of various algorithms useful for biological sequences.
3. Identification Python modules useful to analyse gene and Biological sequences

Course Outcomes: On Successful completion of the course, students will be able to

1. Understand the basics of Python Programming.
2. Develop applications using Python to solve problems.
3. Identify and use Python modules related to Biology.
4. Analyse biological and gene sequences using Python.
5. Understand advanced analysis techniques.
6. Formulate step-wise implementation of a python script for a given problem in bioinformatics

UNIT - I

Introduction to Python: Basics of Python, Python IDEs, Running Python programs, types and operations, Functions, modules, classes, Exceptions.

UNIT - II

Object-Oriented Programming, Modules: Object Oriented Programming, Threads, process, synchronization, databases and persistence, NumPy, SciPy, Image manipulation, Akando and Dancer modules.

UNIT - III

Biological Sequence Analysis: Biopython: Parsing DNA data files, Sequence Analysis, Dynamic Programming, Hidden Markov Model, Genetic Algorithms, Multiple Sequence Alignment, gapped alignment.

UNIT - IV

Advanced Analysis Techniques: Trees, Text Mining, Clustering, Self-Organizing Map, Principal Component Analysis and Numerical Sequence Alignment.

UNIT - V

Expression Analysis: Gene expression array analysis, Spot finding and Measurement, Spreadsheet Arrays and Data Displays, Applications with expression Alignment.

Text Books:

1. Jason Kinser, “Python for Bioinformatics”, Jones & Bartlett Publishers, 2nd Edition, 2013.
2. ReemaThareja “Python Programming”, Oxford Press, 2017.

Suggested Reading:

1. Mark Lutz, “Learning Python”, 3rd edition, O’Reilly, 2007.
2. Alex Martelli, David Ascher, “Python cookbook”, O’Reilly, 2002.

Online Resources:

1. http://www.biopython.org

18CSO 02

JAVA PROGRAMMING AND BIO-JAVA
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Pre-requisites: Basics of any programming language.

Course Objectives: The main objectives of this course are

1. To introduce the concepts of Object-Oriented programming.
2. Prepare the students to develop solutions using OOPs concepts.
3. Design and develop Biotechnology related solutions using Java and Java class libraries.

Course Outcomes: On Successful completion of the course, students will be able to

1. Illustrate the concepts of object-oriented programming to understand the structure and model of Java Programming.
2. Evaluate object oriented design using Inheritance and polymorphism to solve real world problems
3. Demonstrate Java application programs to Handle Exceptions, Files and I/O Streams.
4. Identify the concepts of Interfaces and packages to write java applications.
5. Apply Windows, Containers, GUI components in Java to Build GUI-based applications using AWT and Applets.
6. Develop programs related to Biotechnology problems.

UNIT - I

Java Essentials: Features of Java, OOPs concepts in Java, Elements of java program, Variables, and Literals, Data Types, variables and arrays, Operators, arrays Control structures: if, if-else, nested if, if-else-if, switch, while, do-while, for, break and continue statements.

UNIT - II

Classes and Objects: Introduction to classes and methods, typecasting, access specifiers and modifiers, modifiers, passing arguments, Constructors. Inheritance: Basics of inheritance, types of inheritance, polymorphism.

UNIT - III

Interfaces and Packages: Basics of interfaces, Packages, Exception handling: Types of exceptions and Errors, exception handling, Multithreading concepts. Files and I/O Streams: File Class, Streams, Byte Streams.

UNIT - IV

AWT and Applets: Applets, GUI, Window class hierarchy, Dialog Boxes,, Layout managers, Swing Component Classes, Event-Handling, AWT Graphics classes and Swing Controls.

UNIT - V

StrBio Lib: Molecular Biology Classes, Interfaces to Bioinformatics tools and Databases, General purpose tools, applications. Writing simple Java programs for Biotechnology related problems.

Textbooks:

1. Sagayaraj, Denis, KArthik and Gajalaxmi, “Java Programming”, for Core and Adanced Learners”, University Press, Pvt. Ltd, 2018.
2. Johan-Marc Chandonia, StrBioLib: a Java Library for Development of Custom Computations Structural Biology Applications”, BIO-INFO ALPPLICATIONS NOTE, Vol. 23, No. 15,2007, PP2018-2020 (https:// academic.oup.com/bioinformatics/article-abstract/23/15/2018/203542)

Suggested Reading:

1. Herbert Schildt, “ The complete reference Java 2”, TMH
2. Internet World 60 minute Java by Ed Tittel

Online Resources:

1. https://www.tutorialspoint.com/java/index.htm

18CSO 03

IOT AND APPLICATIONS
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Pre-requisites: Programming Basics.

Course Objectives: The objectives of this course are
1. ImpartnecessaryandpracticalknowledgeofcomponentsinInternetofThings.
2. Underst and working of IoT Systems.
3. DevelopskillsrequiredtobuildIoTbasedsystemsinthefieldofbiotechnology.

Course Outcomes: On Successful completion of the course, students will be able to
1. Understand Internet of Things and its hardware and software components.
2. Interface I/O devices, sensors & communication module.
3. Remotely monitor data and control devices.
4. Hypothesizing real time IoT based projects.
5. Advance towards research based IoT in the field of biotechnology.

UNIT – I
Introduction to IoT: Sensors, Types of sensors and Transducers, Actuators and Types of Actuators.

UNIT – II
Basics of Networking: Functional Components of IoT, IoT interdependencies, IoT Service oriented architecture, IoT categories, IoT gateways, IoT and associated technologies, Key technologies for IoT, IoT challenges.

UNIT – III
IoT Hardware Components: Computing (Arduino/RaspberryPi), Communication, Sensors, Actuators, I/0interfaces, Programming API's (for Arduino/Raspberry Pi).

UNIT – IV
IoT Application Development: Solution framework for IoT applications- Implementation of Device integration ,Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, Authorization of devices

UNIT – V
IoT Systems and Applications: Smart Lighting, Weather Monitoring System, Weather Reporting Bot, Forest Fire Detection, Alcohol Detection System, Smart Parking Environment**.,** Drip-irrigation, Biological water treatment system**,** Work flow Automation in Industries, Smart Intrusion Detection System, monitoring space risks and hazardous conditions in industrial regions like underground tanks , trap door margins.

Textbooks:

1. Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases",CRCPress,2017.
2. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi, 2018.
3. Arshdeep Bahgaand Vijay Madisetti, "Internet of Things: A Hands- on Approach",UniversitiesPress,2014.

Suggested Reading:

1. Dr. SRNReddy, Rachit Tirnkral and Manasi Mishra, "Introduction to Internet of Things: Apractical Approach",ETILabs,2018.
2. Adrian Mc Ewen, "Designing the Internet of Things", Wiley,2013.
3. Raj Kamal, "Internet of Things: Architecture and Design",McGrawHill,2017.
4. CunoPfister,"Getting Started with the Internet of Things", 0Reilly Media,2011.
5. O.Vermesan,P.Friess**, "**Internet of Things–Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers, SeriesinCommunications,2013.

Online Resources / Weblinks / NPTEL Courses:

1. LiDaXu,WuHe, and Shancang Li,"Internet of Things in Industries: A Survey", IEEE Transactions on Industrial Informatics,Vol.10,No. 4, Nov.2014.
2. Gotovtsev, Pavel M., and Andrey V. Dyakov. "Biotechnology and Internet of Things for green smart city application." 2016 IEEE 3rd World Forum on Internet of Things(WF-IoT).IEEE,2016.
3. Yanjing,Sun,etal."Research and design of agriculture in formatization system based on IOT." Journal of Computer Research and Development48(2011):316-331.
4. Somov,Andrey,etal."Bacteria to power the smart sensor applications: Yanjing,Sun,etal."Research and design of agriculture informatization system based on IOT." Journal of Computer Research and Development48(2011):316-331.
5. Han,Shuqing,etal."Analysis of the frontier technology of agricultural IoT and its predication research."IOP Conference Series: Materials Science and Engineering.Vol.231.No.1.IOP Publishing,2017.

18CSO 04

BASICS OF DATA SCIENCE USING R
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Pre-requisites: Probability and Statistics, basics of programming languages.

Course Objectives: The objectives of this course are

1. Understand R programming language.
2. Explore the programming skills needed to use R tool for statistical analysis of Biological data.
3. Analyze biological data.

Course Outcomes: On Successful completion of the course, students will be able to

1. Summarize the basics of R and in-built data visualization packages.
2. Describe the data analysis using Bayesian and stochastic modelling.
3. Relate gibbs, Z- sampling distributions and compare the binomial, chi-square, wilcoxon and Fisher's exact tests in hypothesis testing.
4. Explore the ANOVA in Regression analysis and classify the multivariate data.
5. Experiment with the biological data using R tool and apply clustering algorithms to biological data.
6. Identify R commands for data manipulation and database technologies for datasets of bioinformatics.

UNIT - I

Basics of R: Introduction, R features, setting up and exploring R environment, loading packages, types of data objects in R, working with R data objects, Controlling work space, importing files. Programming with R: Variables and assignment, operators, control structures, Functions-built-in, writing own functions, package creation.

UNIT - II

Data Analysis and Graphics: Data summary functions in R, Graphics technology in R, saving graphics, additional graphics packages. Bayesian Data Analysis: Need of Bayesian approach, Application of Bayes rule, Priors, Likelyhood functions, evaluating the posterior, Applications of Bayesial Statistics in Bioinformatics. Stochastic Modeling: Stochastic process and Markov Processes, Classification of Stochastic processes, modeling a DNA sequence with Markov Chain, Characteristics of Markov Chain.

UNIT - III

MCMC using Brugs: ABO blood type example. Gibbs sampling. Statistical Inference: Sampling distributions, Parameter estimation, interval estimation, bootstrapping, R packages for bootstrapping. Hypothesis Testing: Package ctest, Binomial test, comparing variances, Wilcoxon tests, Chi-Square test, Fisher's Exact tests, Likelihood Ratio tests.

UNIT - IV

ANOVA and Regression: ANOVA table, perforating ANOVA using R, graphical analysis of ANOVA comparison, Regression: Correlations, linear regression model, fitting and testing of regression model, generalization of the model. Working with Multivariate Data: Multivariate data, sample statistics, display of multivariate data, outliers and principal components. Classification of discriminate analysis- classification with two population and more than two populations, cross validation classification trees.

UNIT - V

Clustering methods: measures of dissimilarities, K-means clustering, K-Medoid clustering, Hierarchical clustering-Agglomerate and divisive. R Packages: Bio-conductor and Seqin R.
Data Technologies: R for Data manipulation, example, Database technologies, Bioinformatics resources on the WWW.

Textbooks:

1. Kim Seefeld, Ernest Linder, "Statistics using R with Biological examples", 2007 (https://cran.r-project.org/doc/contrib/Seefeld_StatsRBio.pdf).
2. Robert Gentleman, "R Programming for Bioinformatics", 1st Edition, CRC Press, 2008.

Suggested Reading:

1. Arvil Cohhlan "A Little Book of R for Bioinformatics", Release 1.0, CC ver 3.0

Online Resources:

1. https://epdf.tips/r-programming-for-bioinformatics.html
2. https://epdf.tips/r-programming-for-bioinformatics.htmlhttps://www.cyclismo.org/tutorial/R/objectOriented.html
3. https://www.w3schools.in/r/object-oriented/

18CSO 05

FUNDAMENTALS OF VIRTUAL REALITY
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Course Objectives: The objectives of this course are

1. To introduce hardware and software components of virtual reality.
2. To provide knowledge about geometry of virtual worlds
3. To give an overview of visual physiology, perception and audio in VR
4. To explore the applications of VR in areas like defense and telerobotics.

Course Outcomes: On Successful completion of this course, student will be able to:

1. Define Virtual Reality and describe the components of a VR system
2. Describe input and output devices of virtual reality systems
3. Apply geometric modeling to model real world scenarios
4. Develop interfaces by using visual physiology, visual perception and audio
5. Evaluate virtual reality systems for usability
6. Explore the applications of VR systems in defense, education and telerobotics

UNIT - I

Introduction: The three I's of virtual reality, commercial VR technology and the five classic components of a VR system.

Input Devices: Trackers, Navigation and Gesture Interfaces: Three-dimensional position trackers, navigation and manipulation interfaces, Gesture interfaces.

Output Devices: Graphics displays, sound displays and haptic feedback.

UNIT – II

Modeling: Geometric modeling, kinematics modeling, physical modeling, behaviour modeling, model management.

Human Factors: Methodology and terminology, user performance studies, VR health and safety issues, VR and Society.

UNIT - III

Light and Optics: Basic Behaviour of light, Lenses, Optical aberrations, The Human eye, Cameras, Displays.

Physiology of Human Vision: From the Cornea toPhotoreceptors, From Photoreceptors to the Visual Cortex, Eye movements, Implications for VR. **Visual Perception:** Depth perception, Motion perception, Color Perception.

UNIT - IV

Audio: The Physics of Sound, The Physiology of Human Hearing, Auditory Perception, Auditory Rendering.

Evaluating VR Systems and Experiences: Perceptual Training, Recommendations for Developers, Comfort and VR Sickness, Experiments on Human Subjects.

UNIT – V

Applications of Augmented and Virtual Reality: Gaming and Entertainment, Architecture and Construction, Science and Engineering, Health and Medicine, Aerospace and Defense, Education, Information control and Big Data Visualization, Telerobotics and Telepresence. Human Factors Considerations, Legal and Social Considerations, The Future: Short-term Outlook and Long-term Outlook

Text Books:

1. Gregory C. Burdea and Philippe Coiffet, "Virtual Reality Technology", Second Edition, John Wiley & Sons, Inc., 2003.
2. Steven M. LaVelle, "Virtual Reality", Cambridge University Press, 2019.
3. Steve Aukstakalnis, "Practical Augmented Reality", Addison-Wesley, 2016.

Suggested Reading:

1. George Mather," Foundations of Sensation and Perception", Second Edition, Psychology Press, 2009.
2. Peter Shirley, Michael Ashikhmin, and Steve Marschner, "Fundamentals of Computer Graphics", Third Edition, A K Peters/CRC Press, 2009.
3. K. S. Hale and K. M. Stanney, "Handbook on Virtual Environments", 2nd edition, CRC Press, 2015.

Online Resources:

1. http://msl.cs.uiuc.edu/vr/
2. https://nptel.ac.in/courses/106106139/

18CSO 06

FUNDAMENTALS OF DBMS
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Pre-requisites: File Structures.

Course Objectives: The objectives of this course are

1. To learn data models, conceptualize and depict a database system using E-R diagram.
2. To understand the internal storage structures in a physical DB design.
3. To know the fundamental concepts of transaction processing techniques.

Course Outcomes: On Successful completion of the course, students will be able to

1. Classify the difference between FMS and DBMS; describe the roles of different users and the structure of the DBMS .Design the database logically using ER modeling.
2. Outline the schema of the relational database and key constraints. Develop queries using DDL, DML and DCL of SQL .
3. Identify the inference rules for functional dependencies and apply the principles of normal forms to decompose the relations in a database .
4. Summarize the concepts of dense ,sparse ,ISAM and B+ tree indexing and get familiar with states and properties of transactions.
5. Interpret the locking, time stamp, graph and validation based protocols for concurrency control.
6. Summarize log based recovery techniques to increase the robustness of the database , identify to resolve the deadlocks in the transactions .

UNIT - I

Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Database Users and Administrators Database System Architecture, Application Architectures. Database Design and E-R Model: Basic concepts, Constraints, E-R Diagrams, E-R Design Issues, Extended E-R Features, Specialization and Generalization.

UNIT - II

Relational Model: Structure of Relational Databases, Database Schema, Keys. Structured Query Language: Overviews, SQL Data Types, SQL Queries, Data Manipulation Language Set Operations, Aggregate Functions, Data Definition Language, Integrity Constraints, Null Values, Views, Join Expression. Index Definition in SQL.

UNIT - III

Relational Database Design: Undesirable Properties in Relational Database Design, Functional Dependencies, Trivial and Nontrivial Dependencies, Closure of Set of Functional Dependencies, Closure of Set of Attributes, Irreducible Set of Functional Dependencies, Normalization – 1NF, 2NF, and 3NF, Dependency Preservation, BCNF, Comparison of BCNF and 3NF.

UNIT - IV

Indexing: Basic concepts, Dense and Sparse Indices, Secondary Indices, Tree-Structured Indexing, Indexed Sequential Access Method (ISAM), B+ Tree Index Files. Transaction Management: Transaction Concept – ACID Properties, States of Transaction, Implementation of Atomicity and Durability, Serializability, Recoverability.

UNIT - V

Concurrency Control: Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols, Deadlocks Handling: Deadlock Prevention, Deadlock Detection and Recovery, Recovery System: Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery.

Textbooks:

1. Abraham Silberschatz, Henry F Korth, S Sudarshan, “Database System Concepts”, Sixth Edition, McGraw-Hill International Edition, 2011.
2. Date CJ, Kannan A, Swamynathan S, “An Introduction to Database Systems”, Eight Edition, Pearson Education, 2006.

Suggested Reading:

1. Raghu Ramakrishnan, Johnnes Gehrke, “Database Management Systems”, Third Edition, McGraw Hill, 2003.
2. Ramez Elmasri, Durvasul VLN Somayazulu, Shamkant B Navathe, Shyam K Gupta, “Fundamentals of Database Systems”, Fourth Edition, Pearson Education,2006.

18CSO 07

BASICS OF CYBER SECURITY
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Pre-requisites: Operating System, Computer Network, Cryptography.

Course Objectives: The objectives of this course are

1. To Identify and present indicators that a cybercrime has occurred and understand methods and tools used in cybercrimes.
2. To collect, Process, Analyze and Present Computer Forensics Evidence.
3. To understand the legal perspectives and Organizational implications of Cyber Security

Course Outcomes: On Successful completion of the course, students will be able to

1. List the different types of cybercrimes and analyze legal frameworks to handle cybercrimes.
2. Identify the Tools and Methods used in cybercrimes.
3. Analyze and resolve cyber security issues and laws governing Cyberspace.
4. Describe the need of Digital Forensics and the importance of digital evidence in prosecution.
5. Interpret the commercial activities in the event of significant information security incidents in the Organization.
6. Discuss the vulnerabilities in networking protocols and their mitigation techniques.

UNIT - I

Introduction to Cyber Crime: Cyber Crime: Definition and Origins of the Word, Cyber crime and Information Security, Classification of Cyber Crimes, Cyber Crime: The Legal Perspective, Cyber Crime: An Indian Perspective, A Global Perspective of Cyber Crime.

UNIT - II

Cyber Offenses: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector.
Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT - III

Cyber Security: The Legal Perspectives: Cyber Crime and the Legal Landscape around the World, Need of Cyber laws: the Indian Context, The Indian IT Act, Challenges to Indian Law and Cyber Crime Scenario in India, Digital Signatures and the Indian IT Act, Cyber Crime and Punishment, Cyber Law, Technology and Students: The Indian Scenario.

UNIT - IV

Understanding Cyber Forensics: Introduction ,Digital Forensics Science, Need for Computer Forensics, Cyber Forensics and Digital Evidence, Forensics Analysis of Email, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Cyber Forensics Investigation, Challenges in Computer Forensics.

UNIT - V

Cyber Security: Organizational Implications: Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

Textbooks:

1. Sunit Belpre and Nina Godbole, “Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives”, Wiley India Pvt.Ltd, 2011.
2. Kevin Mandia, Chris Prosise, “Incident Response and computer forensics”, Tata McGraw Hill, 2006.

Suggested Reading:

1. Alfred Basta, Nadine Basta, Mary Brown, Ravinder Kumar, "Cyber Security and Cyber Laws", Paperback – 2018.
2. Mark F Grady, Fransesco Parisi, "The Law and Economics of Cyber Security", Cambridge university press, 2006.

Online Resources:

1. https://www.edx.org/learn/cybersecurity
2. https://www.coursera.org/courses?query=cyber%20security
3. https://swayam.gov.in/course/4002-cyber-law

18CSO 08

OPEN SOURCE TECHNOLOGIES
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Course Objectives: The objectives of this course are
1. Familiarity with Open Source Technologies.
2. Examples of OSS Projects, Advantages of Open Source.
3. Understand the principles, methodologies of OSS.
4. Understand the policies, licensing procedures and ethics of OSS.

Course Outcomes: On Successful completion of the course, students will be able to
1. Able to differentiate between Open Source and Proprietary software and Licensing.
2. Recognize the applications, benefits and features of Open Source Technologies.
3. Understand and demonstrate Version Control System along with its commands.
4. Gain knowledge to start, manage open source projects.
5. Understand and practice the Open Source Ethics.

UNIT – I
Introduction to Open Source: Open Source, need of Open Source, Open Source Principles, Open Source Standards Requirements for Software, OSS success, Free Software, Examples, Licensing, Free Software Vs. Proprietary Software, Public Domain software, History of free software, Proprietary Vs Open Source Licensing Model, use of Open Source Software.

UNIT – II
Fault Tolerant Design: Principles and Open Source Methodology- History, Open Source Initiatives, Open Standards Principles, Methodologies, Philosophy, Software freedom, Open Source Software Development, Licenses, Copyright vs. Copyleft, Patents, zero marginal cost, income-generation Opportunities, Internationalization.

UNIT – III
Case Studies: Apache, BSD, Linux, Mozilla Firefox, Wikipedia, Git, GNU CC, Libre Office.

UNIT – IV
Open Source Project: Starting and Maintaining an Open Source Project, Open Source Hardware, Open Source Design, Open Source Teaching (OST), Open Source Media, What Is A License, How to create your own Licenses. Important FOSS Licenses (Apache, BSD, PL, LGPL), copyrights and copy lefts, Patent.

UNIT – V
Open Source Ethics- Open Source Vs. Closed Source, Open Source Government, Ethics of Open Source, Social and Financial Impact of Open Source Technology, Shared Software, Shared Source, Open Source as a Business Strategy.

Textbooks:
1. Kailash Vadera, Bjhavesh Gandhi “Open Source Technology”, University Science Press, 1st Edition, 2009.
2. Fadi P. Deek and James A. M. McHugh, “Open Source Technology and Policy”, Cambridge University Press.

Suggested Reading:
1. Wale Soyinka, “Linux Administration- A beginner’s Guide”, Tata McGraw Hills.
2. Andrew M. St. Laurent, “Understanding Open Source and Free Software Licensing”, O'Reilly Media.
3. Dan Woods, Gautam Guliani, “Open Source for the Enterprise”, O'Reilly Media.
4. Bernard Golden, “Succeeding with Open Source”, Addison-Wesley Professional.
5. Clay Shirky and Michael Cusumano, “Perspectives on Free and Open Source Software”, MIT press.

18CSO 09

BASICS OF ARTIFICIAL INTELLIGENCE
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Pre-requisites: Basic Mathematics.

Course Objectives: The objectives of this course are
1. To Provide fundamental concepts in Artificial Intelligence.
2. Discuss the various paradigms involved in solving an AI problems which involve perception, reasoning and learning
3. Apply the AI concepts to build an expert system to solve the real-world problems.

Course Outcomes: On Successful completion of the course, students will be able to
1. Identify various search strategies to solve problems.
2. Compare and contrast knowledge representation schemes.
3. Apply Bayesian Networks and Dempster Shafer theory for reasoning
4. Explain the role of agents and interaction with the environment
5. Determine different learning paradigms.
6. Explain robotic architectures and expert systems.

UNIT - I
Introduction: Definition, history, applications. Problem Solving: AI problems, AI Technique, Defining problem as a State-Space Search, Problem Characteristics. Heuristic Search Techniques: Generate–and–test, Hill Climbing, Constraint Satisfaction.

UNIT - II
Knowledge Representation (Logic): Representing facts in logic, proposition logic, predicate logic, resolution and unification. Knowledge Representation (Structured): Declarative representation, Semantic nets, procedural representation, frames.

UNIT - III
Reasoning: Probability and Bayes theorem, Certainty factors and Rule based systems, Bayesian Networks, Dempster-Shafer Theory. Planning: Components, goal stack planning, nonlinear planning, hierarchical planning.

UNIT - IV
Learning: Introduction, Rote learning, learning by taking advice, learning in problem solving and learning from examples: Decision tree. Intelligent Agents: Classification, Working of an agent, single agent and multi agent systems, multi agent application.

UNIT - V
Expert System: Representing and Using Domain Knowledge, Expert systems shells, Explanation, Knowledge Acquisition. Perception and Action: Real Time Search, Vision, Speech Recognition, ACTION: Navigation, Manipulation, Robot architectures.

Textbooks:
1. Elaine Rich, Kevin Night, Shivashankar B Nair, “Artificial Intelligence”, 3rd Edition, 2008
2. Russell Norvig, “Artificial Intelligence-Modern Approach”, 3rd edition, 2010.

Suggested Reading:
1. Saroj Kaushik, “Artificial Intelligence”, Cengage Learning India, 2012.
2. Nelson M. Mattos, “An Approach to Knowledge Base Management”, Springer Berlin Heidelberg, 1991.

Online Resources:

1. http://nptel.ac.in/courses/106106126/
2. http://nptel.ac.in/courses/106105077/

18CSO 10

MACHINE LEARNING USING PYTHON
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Prerequisites: Linear Algebra , basics of python .

Course Objectives: The objectives of this course are
1. Get an idea of Machine Learning algorithms to solve real world problems.
2. Study various machine learning algorithms.
3. Analyze data using machine learning techniques.

Course Outcomes: On Successful completion of the course, students will be able to
1. Define the basic concepts related to Python and Machine Learning.
2. Describe the feature engineering methods, regression techniques and classification methods.
3. Apply Python packages for data visualization. text and time series data analysis using NLP toolkit.
4. Evaluate and interpret the results of the various machine learning techniques.
5. Identify different clustering algorithms.
6. Solve real world problems using deep learning framework.

UNIT - I
Introduction to Machine Learning: Introduction, Machine Learning process. Introduction to Python: Features, sources and installation of Python, IDEs, Basics of Python, Data Structures and loops.

UNIT - II
Feature Engineering: Introduction to Features and need of feature Engineering, Feature extraction and selection, Feature Engineering Methods, Feature Engineering with Python. Data Visualization: Various charts, histograms, plots.

UNIT - III
Regression: Simple and multiple regressions, Model assessment, various types of errors, errors, ridge regression, Lasso regression, non-parameter regression. Classification: Linear classification, logistic regression, Decision Trees, Random Forest, Naïve Bayes.

UNIT - IV
Unsupervised Learning: Clustering, K-Means clustering, Hierarchical clustering. Text Analysis: Basic text analysis with Python, regular expressions, NLP, text classification. Time Series Analysis: Date and time handling, window functions, correlation, time series forecasting.

UNIT - V
Neural Network and Deep Learning: Neural network- gradient descent, activation functions, parameter initialization, optimizer, loss function, deep learning, deep learning architecture, memory, deep learning framework. Recommender System: Recommendation engines, collaborative filtering.

Text Books:
1. Abhishek Vijavargia “Machine Learning using Python”, BPB Publications, 1st Edition, 2018
2. Tom Mitchel “Machine Learning”, Tata McGraWHill, 2017
3. Reema Thareja “Python Programming”, Oxford Press, 2017.

Suggested Reading:
1. Yuxi Liu, “Python Machine Learning by Example”, 2nd Edition, PACT, 2017

Online Resources:

1. https://www.guru99.com/machine-learning-tutorial.html
2. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
3. https://www.tutorialspoint.com/python/
4. https://docs.python.org/3/tutorial/
5. https://www.geeksforgeeks.org/machine-learning/

18CSO 11

COMPUTER GRAPHICS AND ITS APPLICATIONS
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Course Objectives: The objectives of this course are

1. To introduce the use of the components of a graphics system and become familiar with building approach of graphics system components and algorithms related with them.
2. To learn the basic principles of computer graphics.
3. Provide an understanding of how to scan convert the basic geometrical primitives, how to transform the shapes to fit them as per the picture definition.

Course Outcomes: On Successful completion of the course, students will be able to

1. List the basic concepts used in computer graphics.
2. Implement various algorithms to scan, convert the basic geometrical primitives, transformations, Area filling, clipping.
3. Describe the importance of viewing and projections.
4. Define the fundamentals of animation, virtual reality and its related technologies.
5. Enumerate a typical graphics pipeline.
6. Apply various computer graphics algorithms for real world problems.

UNIT - I

Graphics Systems and Models: Graphics system; Images; Physical and synthetic; Imaging system; synthetic camera model; programming interface; graphics architectures Programmable pipelines; performance characteristics. Graphics Programming: Programming two-dimensional applications; OpenGL API; Primitives and attributes; color; viewing, control functions.

UNIT - II

Input and Interaction: Input device; clients and servers; displays lists; display lists and modeling; programming event driven input; picking ; building interactive models; animating Interactive programs; logic operations. Geometrics Objects: Three - dimensional primitives; coordinates systems and frames; frames in OpenGL; Modeling colored cube.

UNIT - III

Transformations: Affine Transformations; Transformations in homogenous coordinates; concatenation of Transformations; OpenGL transformation matrices; Viewing: Classical and Computer views; Viewing with a computer; Positioning of camera; Simple projections; Projections in OpenGL; Hidden surface removal; Parallel-projection matrices; Perspective projection matrices.

UNIT - IV

Lighting and Shading: Light sources; The Phong lighting model; Computational vectors; Polygonal shading; Light sources in OpenGL; Specification of matrices in OpenGL; Global illumination; From Vertices To Frames: Basic implementation strategies; line-segment clipping; polygon clipping; clipping of other primitives; clipping in three dimensions; Rasterization ; Bresenham’s algorithm; Polygon Rasterization ; Hidden surface removal; anti-aliasing; display considerations.

UNIT - V

Modelling & Hierarchy: Hierarchal models; trees and traversal; use of tree data structure; animation; Graphical objects; Scene graphs; Simple scene graph API; Open Scene graph; other tree structures; Curves and Surfaces: Representation of curves and surfaces; design criteria; Bezier curves and surfaces; Cubic Bsplines;
General B-splines; rendering curves and surfaces; curves and surfaces in OpenGL.

Textbooks / Suggested Reading:

1. Edward Angel, “Computer Graphics A Top-Down Approach UsingOpenGL”, Peasrson Education, 5th edition -2009.
2. Fransis S Hill Jr., Stephen M Kelley, “Computer Graphics UsingOpenGL”, Prentice-Hall Inc., 3rd edition , 2007.
3. Jim X. Chen, “Foundation of 3D Graphics Programming Using JOGL and Java3D”, Springe Verlag, 2006.
4. Hearn Donald, Pauline Baker M, “Computer Graphics”, 2nd edition ,1995.

18CSO 12

FUNDAMENTALS OF SOFTWARE ENGINEERING
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Course Objectives: The objectives of this course are

1. To introduce the basic concepts of software development.
2. To impart knowledge on various phases, approaches and practices of software development.
3. To make the student industry ready with study of different techniques and tools.

Course Outcomes: On Successful completion of this course, student will be able to

1. State the software process and the perspective process models and agile process models.
2. Interpret the Requirements of Software Product and demonstrate the skills necessary to specify the requirements of software product.
3. Recall the software architecture and design principles of software product.
4. Construct a product using coding principles and Outline the testing strategies for Conventional and O-O Software.
5. Apply software testing methods like White Box, Black box and explore the corrective, adaptive, and enhancive software maintenance categories.
6. Classify and relate the requirements, design principles and testing strategies to develop a software product.

UNIT - I

The Software Problem, Software Processes- Process and Project, Components of software Processes. **Software Development Process Models**: Waterfall, Prototyping, Iterative Development, RUP, Time Boxing Model. **Agile Process**: Agility, Agile Process Model – Extreme Programming, Using Process Models in a Project.

UNIT - II

Software Requirements Analysis Specification: Value of a Good SRS, Requirements Process, Requirements Specification, Functional Specification with Use-cases, other approaches for Analysis- DFD, E-R. **Planning a Software Project**: Project schedule and staffing, Quality Planning, Risk Management Planning, Project Monitoring Planning.

UNIT - III

Software Architecture: Architecture views, Component and Connector views, Architecture Styles for C&C views. Design: Design Concepts, Function Oriented Design, Object Oriented Design, Detailed Design.

UNIT – IV

Coding: Programming Principles and Guidelines, Incrementally developing code, Managing Evolving code, Unit Testing, Code Inspection. **Testing Concepts**: Test case, Test Suite, Test Harness, Levels of Testing .

UNIT - V

Test Process: Test Plan, Test Case Design, Black – Box Testing, White – Box Testing, Metrics.

Text Books:

1. Pankaj Jalote, “A concise introduction to software Engineering”, Springer, 2008.
2. Nasib SinghGill, “Software Engineering”, Khanna Publishing House, 2007.

Suggested Reading:

1. Roger S.Pressman, “Software Engineering: A Practitioner’s Approach”, 7th Edition, McGraw Hill, 2009.
2. Ali Behforooz and Frederick J.Hudson, “Software Engineering Fundamentals”, Oxford University Press, 1996.

Online Resources:

1. https://nptel.ac.in/courses/106101061/

18CSO 13

FUNDAMENTALS OF BLOCKCHAIN TECHNOLOGY
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Course Objectives: The objectives of this course are

1. Provide the basic concepts and architecture of blockchain.
2. Interpret the working of Ethereum and Hyperledger Fabric.
3. Explore the applications of blockchain in Science and Healthcare domains.

Course outcomes: On Successful completion of the course, students will be able to

1. Understand the concepts of distributed systems and blockchain properties.
2. Learn about the significance of bitcoin ecosystem.
3. Understand consensus mechanisms and technologies that support ethereum.
4. Learn about Hyperledger Fabric and its architecture.
5. Analyze blockchain use cases in Science and Healthcare domains.

Unit I:

Introduction: Overview of distributed systems; Introduction to Blockchain; Properties of Blockchain; Evolution of Blockchain.

Cryptocurrency And Blockchain : Anonymity and Pseudonymity in Cryptocurrency; Programmable Money; Hash Functions and Merkle Trees; Components of Blockchain Ecosystem; Cryptography and Consensus Algorithms; Types of Blockchain; Blockchain Platforms.

Unit II:

Bitcoin Platform: Bitcoin and its uses; Bitcoin Trading: Buying, selling and storing Bitcoins; Bitcoin Ecosystem; Structure of a Bitcoin Transaction; Nodes in a Bitcoin Network; Bitcoin Mining, Bitcoin Economics; Types of bitcoin Mining; Consensus mechanism in bitcoin.

Unit III:

Introduction To Ethereum: What is Ethereum; Introducing Smart Contracts; Cryptocurrency in Ethereum; Mining in Ethereum; Consensus mechanism in Ethereum; Technologies that support Ethereum; Ethereum Programming Language; Ethereum Test Networks.

Unit IV:

Hyperledger Fabric: Introduction to Hyperledger Fabric; Hyperledger Fabric architecture; Consensus in Hyperledger Fabric; Hyperledger API and Application Model; Setting up Development Environment using Hyperledger Composer tool.

Unit V:

Blockchain in Science: Reproducibility Crisis; Clinical Trials; Pharmaceutical Drug Tracking-Prediction Markets and Augar.

Blockchain in Health Care: Patient-Payer-Providers Model; EHR operability: Ark Invest and Gem.

Text Books:

1. Mastering Bitcoin. Programming the Open Blockchain; Andreas M. Antonopoulos; O'Reilly, 2017
2. Bitcoin and Blockchain Security**;** Ghassan Karame, Elli Androulaki; Artech House, 2016.
3. Blockchain and Clinical Trial; Hamid Jahankhani et.al.; Springer (2019)
4. Blockchain Enabled Applications; Vikram Dhillon et al, Apress (2019)

Suggested Reading:

1. Mark Gates, "Blockchain: Ultimate guide to understanding blockchain, bitcoin, cryptocurrencies, smart contracts and the future of money", Wise Fox Publishing and Mark Gates, 2017.
2. Melanie Swa, "Blockchain ",O'Reilly Media, 2014

Online Resources:

1. Blockchain Applications- https://www.blockchain-books.com
2. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric
3. Zero to Blockchain - An IBM Redbooks course, by Bob Dill, DavidSmits, 2017(https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html)
4. https://onlinecourses.nptel.ac.in/noc18_cs47/preview
5. https://www.udemy.com/blockchain-and-bitcoin-fundamentals/