With effect from the Academic Year 2022-23

R-20
B.E. (AI&DS)
Scheme and Syllabus of
VII-VIII Semesters
w.e.f. 2022-23

With effect from the Academic Year 2022-23

1.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

Scheme of Instruction of VII Semester of B.E. – Artificial Intelligence and Data Science as per AICTE Model Curriculum, with effective from 2022-23

DEPARTMENT OF ARTIFICIAL INTELLIGENCE & DATA SCIENCE

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	20ADC14	Big Data Analytics	3		3	40	60	3
2		Professional Elective – 4	3	-	3	40	60	3
3		Open Elective – 1	3	-	3	40	60	3
4	20EGM03	Universal Human Values II: Understanding Harmony	3	-	3	40	60	3
5	20EGMO4	Gender Sensitization	2	-	2	-	50	NC
PRACTICALS								
1	20ADC15	Big Data Analytics Lab		3	3	50	50	1.5
2	20ADC16	Project Part – 1	-	4	-	50	-	2
3		Internship	4-6 Weeks 135 Hours		-	-	-	3
TOTAL			**14**	**7**	**17**	**260**	**340**	**18.5**

L: Lecture **T: Tutorial** **D: Drawing** **P: Practical**
CIE – Continuous Internal Evaluation **SEE - Semester End Examination**

Professional Elective #4	Unmanned Aerial Vehicles 20ITE15	Robotic Process Automation 20ADE10	Business Intelligence 20ADE11	Server Less Computing 20ADE12	Digital Forensics 20ITE26	Reinforcement Learning 20ADE13

Open Elective- 1 (VII Semester)		
S.No.	**Course Code**	**Course Name**
1.	20MEO03	Research Methodologies
2.	20MEO12	3D Printing
3.	20ME O15	Principles of Industry 4.0
4.	20ECO14	Neural Networks and Fuzzy Logic
5.	20EGO01	Technical Writing Skills

With effect from the Academic Year 2022-23

20ADC14 **BIG DATA ANALYTICS**

Instruction	3 Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

1. To introduce the importance of big data, role of Hadoop framework in analyzing large datasets by writing mapper and reducer for a given problem.
2. To familiarize writing queries in Pig and Hive to process big data
3. To present latest big data frameworks and applications using Spark and Scala.
4. To discuss the concept and writing applications using SparkSQL
5. To provide the concepts of NoSQL databases and study the working mechanisms of MongoDB.

Course Outcomes:

Upon completing this course, students will be able to:

1. Understand the processing large datasets in Hadoop framework and Apply MapReduce architecture to solve real world problems.
2. Develop scripts using Pig over large datasets and query using Hive.
3. Understand the fundamentals of Spark and the Scala programming.
4. Expertise in using Resilient Distributed Datasets (RDD) for creating applications in Spark and query using SparkSQL.
5. Understand NoSQL databases and Develop data models using MongoDB.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2	-	-	-	-	-	-	-	2	3	3	3
CO2	3	3	2	2	-	-	-	-	-	-	-	2	3	3	2
CO3	3	3	2	2	-	-	-	-	-	-	-	2	3	3	3
CO4	3	3	2	2	-	-	-	-	-	-	-	2	3	3	2
CO5	3	3	2	2	-	-	-	-	-	-	-	2	3	3	3

UNIT-I

What is Big Data? Why is Big Data Important: When to consider a Big data solution, Big Data use cases **The Hadoop Distributed Files system:** The Design of HDFS, HDFS Concepts, HDFS Federation, HDFS High Availability, Basic File system Operations, Hadoop File systems, Anatomy of a File Read, Anatomy of a File Write. **Map Reduce:** What is Map reduce, Architecture of map reduce. **How Map Reduce Works**: Anatomy of a Map Reduce Job Run, Failures in Map Reduce. **Map Reduce Types and Formats:** Map Reduce Types, The Default Map Reduce Job, Input Formats, Input Splits and Records, Text Input, Output Formats, Text Output, Developing a Map Reduce Application

UNIT-II

Pig: Installing and Running Pig, an Example, Generating Examples, Comparison with Databases, Pig Latin, User-Defined Functions, Data Processing Operators, Pig in Practice. **Hive:** Installing Hive, The Hive Shell, An Example, Running Hive, Comparison with Traditional Databases, Hive QL, Tables, Querying Data, User-Defined Functions, Writing a User Defined Functions, Writing a User Defined Aggregate Function

UNIT-III

Introduction to Spark: What is Apache Spark, History of Spark, The Present and Future of Spark, Running Spark, Spark's Basic Architecture Spark Applications Spark's Language APIs Spark's APIs Starting Spark, The Spark Session Data Frames, Partitions, Transformations, Lazy Evaluation, Actions, Spark UI, An End-to-End Example, Data Frames and SQL. **Spark's Toolset:** Running Production Applications, Datasets: Type-Safe Structured APIs, Structured Streaming, Machine Learning and Advanced Analytics, Lower-Level APIs, Spark R, Spark's Ecosystem and Packages.

UNIT-IV

Spark SQL: What Is SQL?, Big Data and SQL: Apache Hive, Spark SQL, Spark's Relationship to Hive, How to Run Spark SQL Queries, Catalog, Tables, Views, Databases, Select Statements, **Datasets**: When to Use Datasets, Creating Datasets, Actions, Transformations **Resilient Distributed Datasets**: Introduction to RDDs, Creating RDDs, Manipulating RDDs, Transformations, Actions, Saving Files, Caching, Check pointing, Pipe RDDs to System Commands

UNIT-V

No SQL Databases: Review of traditional Databases, Need for NoSQL Databases, Columnar Databases, Failover and reliability principles, CAP Theorem, Differences between SQL and NoSQL databases, **Working mechanisms of Mongo DB**: Overview, Advantages, Environment, Data Modelling, Create Database, Drop Database, Create collection, Drop collection, Data types, Insert, Query, Update and Delete operations, Limiting and Sorting records, Indexing, Aggregation.

Text Books:

1. Tom White, "Hadoop: The Definitive Guide", 4th Edition, O'Reilly Media Inc, 2015.
2. Bill Chambers, Matei Zaharia, "Spark: The Definitive Guide", 4th Edition, O'Reilly Media Inc, 2018

Suggested Reading:

1. Thilinagunarathne Hadoop MapReduce v2 Cookbook – 2nd Edition, Packet Publishing, 2015.
2. Chuck Lam, Mark Davis, Ajit Gaddam, "Hadoop in Action", Manning Publications Company, 2016.
3. Alex Holmes," Hadoop in Practice", Manning Publications Company, 2012.
4. Alan Gates, "Programming Pig", O'Reilly Media Inc, 2011.
5. Edward Capriolo, Dean Wampler, and Jason Rutherglen, "Programming Hive", O'Reilly Media Inc, October 2012.

Web Resources:

1. http://www.planetcassandra.org/what-is-nosql
2. http://www.iitr.ac.in/media/facspace/patelfec/16Bit/index.html
3. https://class.coursera.org/datasci-001/lecture
4. http://bigdatauniversity.com

20ITE15 **UNMANNED AERIAL VEHICLES**

(Professional Elective – 4)

Instruction	3 Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives

1. Understand the basics of Unmanned Aerial Vehicles (Drones) and its various applications.
2. Learn the working principle of the drone and explain the components that are used to build the drone devices.
3. Provide hands-on experience on design, fabrication and flying of UAV category aircraft.
4. Explain the rules and regulations to the specific country to fly drones.
5. Introduce safety measures to be taken during flight.

Course Outcomes

After the completion of the course, the student will be able to:

1. Identify the parts and functions of UAV and drones
2. Demonstrate the concepts of Aerodynamics, Propulsion & Structures of Model Aircrafts
3. Determine the payload and its corresponding propeller's RPM to successfully fly the drone
4. Design a drone with an automatic recovery mechanism.
5. Understand Navigation of UAV.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	3	-	-	3	-	-	-	-	-	-
CO3	-	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	-	-	-	-	-	-	-	-	3	-	3	-
CO5	3	3	3	3	3	3	-	-	-	-	-	-	-	3	-

UNIT-I

Introduction to Flight and UAVs - Basics of Flights - Different types of flight vehicles - Components and functions of an airplane - Forces acting on Airplane - Physical properties and structure of the atmosphere.
UAV (Unmanned Aerial Vehicle) – Definition – History – Characteristics of UAV - Applications of UAV (Defence, Civil, Environmental monitoring) – Difference between Aircraft and UAV.

UNIT-II

Fundamental Components of a Drone – Types of Drones – Components of a Drone – Frames: Lightweight and sold material – Working principles of Electromagnetic Motors – Types of Motors (Brushed DC motor, Brushless DC motor, Induction Motor) – Microcontroller/microprocessor (Arducopter Flight Controller) –Working principles of Electromagnetic radiations – Radio Transmitter and Receiver – Li-ion Battery – Electric Speed Controller – Global Positioning System – Camera.

UNIT-III

Payload for UAV: Payloads – Classification of Payloads – camera – sensors – radars – various measuring devices – classification of payload based on applications – Hyper spectral sensors – laser detection and range – synthetic aperture radar – thermal cameras – ultrasonic detectors - case study on payloads.

UNIT-IV

Launch and Recovery: Launching systems - UAV Launch Methods for Fixed-Wing Vehicles - Vertical Take-off and Landing UAV Launch – Automatic Recovery systems.

Regulatory and regulations: Civil Aviation Requirements, DGCA RPAS Guidance Manual, UAS Rules 2021**.**

UNIT-V

UAV Navigation and Guidance System: Navigation - Dead Reckoning – Inertial – Radio Navigation – Satellite – Way point Navigation. Dijkstra's Algorithm – A- star Algorithm – UAV Guidance – Types of guidance - UAV communication systems - Ground control station – Telemetry - UAS future -

Text Book(s):

1. Andey Lennon "Basics of R/C model Aircraft design" Model airplane news publication.
2. Theory, Design, and Applications of Unmanned Aerial Vehicles.

Reference Book(s):

1. Tom White. Hadoop - The Definitive Guide, 4th Edition, O'Reilly Publications, India, 2015.
2. Judith Hurwitz, Alan Nugent, Dr. Fern Halper, Marcia Kaufman. Big Data for Dummies, John Wiley & Sons, Inc., 2013.
3. Jane's Unmanned Aerial Vehicles and Targets -by Kenneth Munson (Editor), 2010
4. Guidance of Unmanned Aerial Vehicles- by Rafael Yanushevsky (Author), 2011.

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20ADE10 **ROBOTIC PROCESS AUTOMATION**

(Professional Elective – 4)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

1. To understand basic concepts of RPA
2. To Describe IIPA, where it can be applied and how it implemented
3. To Describe the different types of variables, Control Flow and data manipulation techniques
4. To Understand Image, Text and data Tables Automation
5. To describe various types of Exceptions and strategies to handle

Course Outcomes:

After successful completion of the course, student will be able to:

1. To Understand the basic concepts of RPA
2. To Describe various components and platforms of RPA
3. To Describe the different types of variables, control flow and data manipulation techniques
4. To Understand various control techniques and OCR in RPA
5. To Describe various types and strategies to handle exception

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	2	2	2	0	0	0	0	0	0	0	1	0	0	0
CO2	2	2	1	1	1	0	0	0	0	0	0	1	2	0	0
CO3	2	3	1	2	1	0	0	0	0	1	0	1	3	0	2
CO4	1	2	1	1	0	0	1	0	0	1	1	0	2	0	0
CO5	2	2	1	2	1	0	1	0	0	0	1	0	0	0	2

UNIT-I

RPA Foundations- What is RPA - flavors of RPA- history of RPA- The Benefits of RPA- The downsides of RPA- RPA Compared to BPO, BPM and BPA - Consumer Willingness for Automation- The Workforce of the Future- RPA Skills- On-Premise Vs. the Cloud- Web Technology- Programming Languages and Low Code- 0CR-Databases-APls- Al-Cognitive Automation-Agile, Scrum, Kanban and Waterfall Devops- Flowcharts.

UNIT-II

RPA Platforms- Components of RPA- RPA Platforms-About Ui Path- About UiPath - The future of automation - Record and PIay - Downloading and installing UiPath Studio -Learning Ui Path Studio- - Task recorder - Step-by step examples using the recorder.

UNIT-III

Sequence, Flowchart, and Control Flow-sequencing the workflow- Activities-Control flow, various types of loops, and decision making-Step-by step example using Sequence and Flowchart-Step-by-step example using Sequence and Control Flow-Data Manipulation-Variables and Scope Collections-Arguments - Purpose and use-Data table usage with examples Clipboard Management-File operation with step-by-step example-CSV/Excel to data table and vice versa (with a step-by-step example).

UNIT -IV

Taking Control of the Controls- Finding and attaching windows- Finding the 08 control- Techniques for waiting for a control- Act on controls - mouse and keyboard activities- Working with Ui Explorer- Handling events- Revisit recorder- Screen Scraping- When to use OCR- Types of 0CR available- How to use 0CR- Avoiding typical failure points.

UNIT-V

Exception Handling, Debugging, and Logging- Exception handling- Common exceptions and ways to handle them- Logging and taking screenshots Debugging techniques- Collecting crash dumps- Error reporting- Future of RPA.

Text Books:

1. Tom Taulli, The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems,2020, lSBN-13 (electronic):978-7-4842-5729-6, Publisher: A press
2. Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: Packt Publishing Release Date: March 2018 ISBN: 9787788470940

Reference Books:

1. Frank Casale, Rebecca Dilla, Iieidi Jaynes,Lauren Livingston," lntroduction to Robotic Process Automation: a Primer", Institute of Robotic Process Automation.
2. Richard Murdoch, Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks & Become an RPA Consultant
3. Srikanth Merianda, Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation

Web Resources:

1. Learning Robotic Process Automation, https://www.packtpub.com/in/business/learning-robotic-process-automation
2. Automation Anywhere University, https://university.automationanywhere.com/
3. https://www.urbanpro.com/ghaziabad/rpa-robotics-process-automation-automation-anywhere/11461411

20ADE11 **BUSINESS INTELLIGENCE**
(Professional Elective – 4)

Instruction	3 Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

1. Exposed with the basic rudiments of the business intelligence system.
2. Understand the architectural aspects behind Business Intelligence
3. Understand data science, data visualization dashboard design, performance dashboard and future of BI.
4. Implement the business intelligence life cycle and the techniques used in it.
5. Exposed with different visualization, data analysis tools and techniques

Course Outcomes:

At the end of the course, student will be able to

1. Understand the concepts and components of Business Intelligence (BI) and Decision support systems.
2. Analyze how BI will help an organization and whether it will help yours.
3. Identify the technological architecture that makes up BI systems
4. Use the tools that make up BI (data science).
5. Plan the implementation of a BI system

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-		-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	3	-	-	3	-	-	-	-	-	-
CO3	-	-	-	-	3	-	-	-	-	-	-	-	3	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO5	3	3	3	3	3	3	-	-	-	-	-	-	-	-	-

UNIT-I

Introduction to Business Intelligence: BI concept, BI architecture, BI in today's perspective, BI Process, Applications of BI like Financial analysis, statistical analysis, sales analysis, CRM, result pattern and ranking analysis, Balanced Scorecard.
BI in Decision Modelling: Optimization, Decision making under uncertainty. Ethics and business intelligence.

UNIT-II

Data Science: The concept, process and typical tools in data science. Example of different algorithms i.e segmentation, classification, validation, regressions, recommendations. Exercises using Excel and R to work on histograms, regression, clustering and text analysis. Co-relation between Algorithm and Code in data science.

UNIT-III

Decision support systems: Definition of system, Representation of the decision-making process, Evolution of information systems, Definition of decision support system, Development of a decision support system
Mathematical models for decision making: Structure of mathematical model, Development of a model, Classes of models.

UNIT-IV

Data Visualization and Dashboard Design Responsibilities of BI analysts by focusing on creating data visualizations and dashboards. Importance of data visualization, types of basic and composite charts. Performance Dashboard Measuring, Monitoring and management of Business, KPIs and dashboard, the types of dashboards, the common characteristics of

Enterprise dashboard, design of enterprise dashboards, and the common pitfalls of dashboard design.

UNIT-V

Business Intelligence Applications: Marketing models: Relational marketing, Salesforce management, Business case studies. **Logistic and production models:** Supply chain optimization, Optimization models for logistics planning, Revenue management systems, Business case studies. **Data envelopment analysis:** Efficiency measures, Efficient frontier, The CCR model, Identification of good operating practices.

Text Books:

1. Efraim Turban, Ramesh Sharda, Dursun Delen, "Decision Support and Business Intelligence Systems", 9th Edition, Pearson 2013 (1,4 units)
2. Carlo Vercellis, Business Intelligence: Data Mining and Optimization for Decision Making by, wiley publishers.2009 (2,3,5 Units)

Suggested Reading:

1. "Business Intelligence – Grundlagen und praktische Anwendungen: Eine Einführung in die IT" by Hans-Georg Kemper and Henning Baars.
2. David Loshin Morgan, Kaufman, "Business Intelligence: The Savvy Manager"s Guide", Second Edition, 2012.
3. Larissa T. Moss, S. Atre, "Business Intelligence Roadmap: The Complete Project Lifecycle of Decision Making", Addison Wesley, 2003.
4. Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for Decision Making", Wiley Publications, 2009.

20ADE12 **SERVERLESS COMPUTING**
(Professional Elective – 4)

Instruction	3 Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

1. Fundamentals of Serverless computing
2. Concepts of event driven applications
3. Difference between containerization and serverless computing.
4. How to use AWS lamda to build serverless applications
5. Automation with Serverless applications

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Understand the evolution of computing and architectures.
2. Summarize the requirements of serverless computing.
3. Develop event driven applications.
4. Use AWS Lambda for serverless applications.
5. Develop Functions for serverless applications in AWS Lambda

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	3	-	-	-	-	3	3
CO3	3	3	3	3	3	-	-	-	-	-	3	-	-	2	2
CO4	3	3	3	3	3	-	-	-	-	-	3	3	-	2	2
CO5	3	3	3	3	3	3	-	-	-	-	3	3	-	2	2

UNIT-I

The Evolution of Compute, Understanding enterprise data centers, Exploring the units of compute, Understanding software architectures, Predicting what comes next

UNIT-II

Introduction: Serverless computing, Serverless and event-driven collision, Introduction to FaaS, FaaS states, benefits, Comparison with PaaS,Comparison with containers, #NoOps, Limitations of serverless computing.

UNIT-III

Event-Driven Applications, Understanding modern applications, Evolution of integration patterns, Automation with serverless.

UNIT-IV

AWS Lambda: Getting Started with AWS Lambda, What is AWS Lambda?, How does AWS Lambda work,Use cases, Execution environment, AWS Lambda Function–Hello World, Configuring options for AWS Lambda, Securing AWS Lambda using IAM.

UNIT-V

The Foundations of a Function in AWS, Technical requirements, Learning about AWS Lambda, Fundamentals of a function, Use cases, Setting up security, Invoking Lambda functions, Anatomy of a Lambda function, The programming model, Writing your first Lambda function, Adding Amazon API Gateway, Introducing Amazon API Gateway, Serverless APIs, Securing an API, Building, deploying, and managing APIs, Building a Lambda-backed API.

Text Books:

1. Learn AWS Serverless Computing By Scott Patterson · 2019, Packt Publishers.
2. Hands-On Serverless Computing b Kuldeep Chowhan, 2018 Packt Publishing

Web Resources:

1. https://journalofcloudcomputing.springeropen.com/articles/10.1186/s13677-021-00253-7
2. https://cacm.acm.org/magazines/2019/12/241054-the-rise-of-serverless-computing/fulltext

20ITE26 **DIGITAL FORENSICS**
(Professional Elective – 4)

Instruction	3 Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

1. To study Digital Forensic concepts and the investigative process
2. To learn about the legal issues of digital forensic analysis and the role of investigator.
3. To study the data acquisition, identification and storage of digital Evidence.
4. To Learn the usage of digital forensics tools.
5. To learn E-mail Investigation and Mobile device forensics.

Course Outcomes:

Upon successful completion of the course, students will able to

1. Describe digital forensics and relate it to an investigative process.
2. Explain the legal issues of preparing for and performing digital forensic analysis based on the investigator's position and duty.
3. Interpret the cyber pieces of evidence, Digital forensic process model and their legal perspective.
4. Demonstrate various forensic tools to investigate the cybercrime and to identify the digital pieces of evidence.
5. Analyze the digital evidence used to commit cyber offenses.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	2	-	2	-	-	-	-	-	3	-
CO3	-	-	-	1	-	2	-	2	-	-	-	-	-	3	-
CO4	-	-	-	2	3	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-

UNIT –I

Computer Forensics Fundamentals: What is Computer Forensics? Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/Employment Proceedings, Computer Forensics Services, Benefits of Professional Forensics Methodology, Steps taken by Computer Forensics Specialists. **Types of Computer Forensics Technology**: Types of Military Computer Forensic Technology, Types of Law Enforcement Computer Forensic Technology, Types of Business Computer Forensic Technology.

UNIT- II

Understanding Digital Forensics and Investigations: Procedure for Private Sector High-Tech investigations, Understanding Data Recovery Workstations and Software, Conducting an investigation. **Data Acquisition:** Understanding Storage Formats for Digital Evidence, Determining the Best Acquisition Method, Using Acquisition Tools, Validating Data Acquisitions, Performing RAID Data Acquisitions, Remote Network Acquisition Tools, Other Forensics Acquisition Tools.

UNIT-III

Processing Crime and Incident Scenes: Identifying Digital Evidence, Collecting Evidence in Private-Sector Incident Scenes, Processing Law Enforcement Crime Scenes, Preparing for a Search, Securing a Digital Incident or Crime Scene, Seizing Digital Evidence at the Scene, Storing Digital Evidence, Obtaining a Digital Hash, Reviewing a Case.

UNIT-IV

Current Digital Forensics Tools: Evaluating Computer Forensic Tool Needs, Digital Forensics Software Tools, Digital Forensics Hardware Tools, Validating and Testing Forensics Software. **Digital Forensics Analysis and Validation:** Determining What Data to Collect and Analyse, Validating Forensic Data, Addressing Data-Hiding Techniques.

UNIT-V

E-Mail and Social Media Investigations: Exploring the Role of E-Mail in Investigation, Exploring the Roles of the Client and Server in E-Mail, Investigating E-Mail Crimes and Violations, Understanding E-Mail Servers, Using Specialized E-Mail Forensic Tools, Applying Digital Forensics Methods to Social Media Communications. **Mobile Device Forensics and Internet of Anything:** Understanding Mobile Device Forensics, Understanding Acquisition Procedures for Mobile Devices.

Text Books:

1. Vacca, J, Computer Forensics, Computer Crime Scene Investigation, Charles River Media, 2015.
2. Nelson, B, Phillips, A, Stuart, C., "Guide to Computer Forensics and Investigations", 5th edition., Cengage Learning, 2016.

Suggested Reading:

1. John Sammons," The basics of digital Forensics – The primer for getting started in digital forensics", Elsevier Syngress Imprint, 2012.
2. Richard Boddington," Practical Digital Forensics" [PACKT] Publication, Open-source community, 2016.

20ADE13 **REINFORCEMENT LEARNING**
(Professional Elective – 4)

Instruction	3 Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

1. To present an overview of reinforcement learning concepts, Multi Armed bandits problem, Finite MDP.
2. To introduce Dynamic programming, Monte Carlo methods and Temporal-Difference Learning.
3. To familiarize Planning and Learning with Tabular Methods, Prediction with Approximation.
4. To provide information about Reinforcement learning mechanisms.
5. To facilitate remarkable point of contact between reinforcement learning and neuroscience.

Course Outcomes:

After successful completion of the course, student will be able to:

1. Explain the fundamental concepts of reinforcement learning and finite markov decision process.
2. Design a Reinforcement Learning system that knows how to make automated decisions
3. Illustrate the integration of model-based and model-free methods.
4. Analyse how a learning algorithm can be implemented in a different ways to obtain computational advantages.
5. Discuss parallels between reinforcement learning and neuroscience

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	2
CO2	-	-	-	-	-	2	-	2	-	-	-	-	-	3	2
CO3	-	-	-	1	-	2	-	2	-	-	-	-	-	3	2
CO4	-	-	-	2	3	-	-	-	-	-	-	-	-	3	2
CO5	-	-	-	1	-	-	-	1	-	-	-	-	-	0	2

UNIT-I

Introduction: Reinforcement Learning, Elements of Reinforcement Learning, Limitations and Scope, Examples. **Multi Armed Bandits:** A K-armed Bandit Problem**,** Action-Value Methods, Incremental implementation, tracking a Non-stationary problem, Optimistic initial values, UCB, GBA, Associative search. **Finite Markov Decision Process:** The Agent-Environment Interface, Goals and Rewards, Returns and Episodes, Unified Notation for Episodic and Continuing Tasks, Policies and Value Functions, Optimal Policies and optimal Value Functions, Optimality and Approximation.

UNIT-II

Dynamic Programming: Policy Evaluation (Prediction), Policy Improvement, Policy Iteration, Value Iteration, Asynchronous dynamic programming, Generalized Policy Iteration, Efficiency of dynamic programming. **Monte Carlo Methods:** Monte Carlo Prediction, Monte Carlo Estimation of Action values, Monte Carlo Control, Monte Carlo Control without Exploring Starts, Off-policy prediction via Importance Sampling, Incremental implementation. **Temporal-Difference Learning:** TD Prediction, Advantages of TD Prediction Methods, Optimality of TD(0), Sarsa: On-policy TD control, Q-learning Off-policy TD control.

UNIT-III

Planning and Learning with Tabular Methods: Models and Planning, Dyna: Integrated Planning, acting and learning, Prioritized Sweeping, Expected vs Sample updates, Trajectory sampling, Real-time dynamic programming, Planning at decision time, Heuristic search, Rollout algorithms, Monte carlo tree search. **Approximate Solution Methods: On-policy Prediction with Approximation:** Value-function approximation, stochastic-gradient and semi-gradient methods, linear methods, Feature construction for linear methods, selecting step-size parameters manually, Nonlinear function approximation: ANN, Least-squares TD, Memory based function approximation, and Kernel-based function approximation.

UNIT-IV

Eligibility Traces: The λ -return, TD (λ), n-step truncated λ -return methods, Online λ-return algorithm, True online TD (λ), Stable off-policy methods with traces, Implementation issues. **Policy Gradient Methods:** Policy Approximation and its advantages, The Policy Gradient theorem, **Reinforce:** Monte Carlo Policy Gradient, Reinforce with Baseline, Actor-Critic methods, Policy gradient for continuing problems, Policy parameterization for continuous actions.

UNIT- V

Neuroscience: Neuroscience basics, The reward prediction error hypothesis, Dopamine, Neural Actor-Critic, Actor and critic learning rules, Hedonistic Neurons, Collective reinforcement learning. **Applications and Case studies**

Text Books:

1. Sutton & Barto, "Reinforcement Learning: An Introduction", MIT Press 2018, 2nd Edition. .

Suggested Reading:

1. Vincent François-Lavel, Peter Henderson, Riashat Islam, Marc G. Bellemare, Joelle Pineau "An Introduction to Deep Reinforcement Learning", Now Publishers, 2018
2. Csaba Szepesvari, "Algorithms for Reinforcement Learning", Morgan & Claypool Publishers, 2010
3. Maxim Lapan "Deep Reinforcement Learning Hands-On" Packt publisher, 2nd edition, 2020

Web Resource:

1. Nptel Course: Reinforcement Learning: https://nptel.ac.in/courses/106/106/106106143/
2. Swayam Course: Reinforcement Learning: https://swayam.gov.in/nd1_noc19_cs55/preview

20EGMO3 UNIVERSAL HUMAN VALUES-II: UNDERSTANDING HARMONY
(**B.E/B.Tech II/III Year** -Common to all branches)

Instruction	3 Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Introduction

This course discusses the role of human values in one's family, in society and in nature. In the Induction Program, students would get an initial exposure to human values through Universal Human Values–I. This exposure is to be augmented by this compulsory full semester foundation course.

Course Objectives:

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in human being, family, society and nature/existence.
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

Course Outcomes:

Upon successful completion of the course the students will be able to:

1. Students are expected to become more aware of themselves, and their surroundings (family, society, nature)
2. They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature inmind.
3. They would have better critical ability.
4. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
5. It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	-	-	-	-	-	-	-	-	2	2	2	-	-	-	-
CO 2	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	-	2	-	-	-	-	-	2	-	-	2	-	-	-	-
CO 5	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-

Unit 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

- Purpose and motivation for the course, recapitulation from Universal HumanValues-I
- Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
- Continuous Happiness and Prosperity- A look at basic Human Aspirations
- Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of aspirations of every human being with their correct priority
- Understanding Happiness and Prosperity correctly- A critical appraisal of the current Scenario
- Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

Unit 2: Understanding Harmony in the Human Being - Harmony in Myself

- Understanding human being as a co-existence of the sentient 'I' and the material'Body'
- Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
- Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
- Understanding the characteristics and activities of 'I' and harmony in'I'
- Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
- Programs to ensure Sanyam and Health.

Unit 3: Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship

- Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values ofrelationship
- Understanding the meaning of Trust; Difference between intention andcompetence
- Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
- Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co -existence as comprehensive HumanGoals
- Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Unit 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

- Understanding the harmony in theNature
- Interconnectedness and mutual fulfilment among the four orders of nature - recyclability and self- regulation innature
- Understanding Existence as Co-existence of mutually interacting units in all - pervasivespace
- Holistic perception of harmony at all levels ofexistence.

Unit 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

- Natural acceptance of human values
- Definitiveness of Ethical Human Conduct
- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
- Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
- Case studies of typical holistic technologies, management models and production systems
- Strategy for transition from the present state to Universal Human Order:
  a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers
  b. At the level of society: as mutually enriching institutions and organizations

Assessment:

This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self- assessment, peer assessment etc. will be used in evaluation. Example:
Assessment by faculty mentor: 10
marks Self-assessment/Assessment
by peers: 10 M
Socially relevant project/Group Activities/Assignments: 20
marks Semester End Examination: 60 marks
The overall pass percentage is 40%. In case the student fails, he/she must repeat the course.

Text Books

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Valuesand Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1 The teacher's manual
2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN978-93-87034-53-2

Reference Books

1. A Nagaraj Jeevan Vidya: EkParichaya, Jeevan Vidya Prakashan, Amar kantak,1999.
2. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi,2004.
3. Cecile Andrews, Slow isBeautiful
4. Gandhi - Romain Rolland (English)
5. Dharampal, "Rediscovering India"
6. E. FSchumacher. "Small isBeautiful"
7. J. C. Kumarappa "Economy ofPermanence"
8. Pandit Sunderlal "Bharat Mein AngrejiRaj"
9. Mohandas Karamchand Gandhi "The Story of My Experiments withTruth"
10. 10.Mohandas K. Gandhi, "Hind Swaraj or Indian Home Rule"
11. Maulana Abdul Kalam Azad, India Wins Freedom-
12. Vivekananda - Romain Rolland(English)
13. The Story of Stuff(Book)

20EGMO4 **GENDER SENSITIZATION**

Instruction	3 Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	--
Credits	--

Course Objectives

This course will introduce the students to:

1. Sensibility regarding issues of gender in contemporary India.
2. A critical perspective on the socialization of men and women.
3. Popular debates on the politics and economics of work while helping them reflect critically on gender violence.

Course Outcomes

After successful completion of the course the students will be able to:

1. Understand the difference between "Sex" and "Gender" and be able to explain socially constructed theories of identity.
2. Recognize shifting definitions of "Man" and "Women" in relation to evolving notions of "Masculinity" and "Femininity".
3. Appreciate women's contributions to society historically, culturally and politically.
4. Analyze the contemporary system of privilege and oppressions, with special attention to the ways gender intersects with race, class, sexuality, ethnicity, ability, religion, and nationality.
5. Demonstrate an understanding ofpersonal life, the workplace, the community and active civic engagement through classroom learning.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	2	2	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	2	2	-	2	-	-	-

UNIT – I

Understanding Gender:
Gender: Why Should We Study It? (*Towards a World of Equals*: Unit -1)
Socialization: Making Women, Making Men (*Towards a World of Equals*: Unit -2)
Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.

UNIT – II

Gender And Biology:
Missing Women: Sex Selection and Its Consequences (*Towards a World of Equals*: Unit -4)
Declining Sex Ratio. Demographic Consequences.
Gender Spectrum: Beyond the Binary (*Towards a World of Equals*: Unit -10)
Two or Many? Struggles with Discrimination.

UNIT – III

Gender andLabour:
Housework: the Invisible Labour (*Towards a World of Equals*: Unit -3)
"My Mother doesn't Work." "Share the Load."
Women's Work: Its Politics and Economics (*Towards a World of Equals*: Unit -7)
Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.

UNIT-IV

Issues Of Violence
Sexual Harassment: Say No! (*Towards a World of Equals*: Unit -6)
Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "*Chupulu".*
Domestic Violence: Speaking Out (*Towards a World of Equals*: Unit -8)
Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading: New Forums for Justice. Thinking about Sexual Violence (*Towards a World of Equals*: Unit -11)
Blaming the Victim-"I Fought for my Life…." - Additional Reading: The Caste Face of Violence.

UNIT – V

Gender: Co - Existence
Just Relationships: Being Together as Equals (*Towards a World of Equals*: Unit -12)
Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers.
Additional Reading: Rosa Parks-The Brave Heart.

Textbook:

1. A. Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote,VasudhaNagaraj, AsmaRasheed, GoguShyamala, DeepaSreenivas and Susie Tharu "Towards a World of Equals: A Bilingual Textbook onGender" published by Telugu Akademi, Hyderabad,Telangana State, 2015.

Suggested Reading:

1. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
2. AbdulaliSohaila. "I Fought For My Life…and Won."Available online at: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

Web Resources:

1. https://aifs.gov.au/publications/gender-equality-and-violence-against-women/introduction
2. https://theconversation.com/achieving-gender-equality-in-india

With effect from the Academic Year 2022-23

20ADC15 **BIG DATA ANALYTICS LAB**

Instruction	3 Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

Course Objectives:

This course is introduced to

1. To provide the knowledge to set up a Hadoop Cluster and implement applications using MapReduce.
2. To introduce Pig, PigLatin and HiveQL to process big data.
3. To get familiarized with the latest big data frameworks and writing applications using Spark and Scala.
4. To learn querying large datasets with SparkSQL.
5. To gain knowledge to work with NoSQL databases.

Course Outcomes:

After successful completion of the course, student will be able to:

1. Explain Hadoop working environment and develop applications using MapReduce framework.
2. Develop scripts using Pig to solve real world problems and query the datasets using Hive.
3. Develop applications in Spark environment using RDDs.
4. Query real time data using SparkSQL.
5. Query large datasets using NoSQL.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	2	-	2	-	-	-	-	-	3	-
CO3	-	-	-	1	-	2	-	2	-	-	-	-	-	3	-
CO4	-	-	-	2	3	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-

List of Programs:

1. Exploring and using basic HDFS commands.
2. Implement following applications using Mapreduce on single node cluster
   (i) Word Count Application
   (ii) Analysis of Weather Dataset
   (iii) Uber Data Analysis
   (iv) Web Log Analysis
3. Working with Pig Latin Script and HiveQL.
4. Understanding the processing of large dataset on Spark framework and working with Spark SQL.
5. Designing and modeling NOSQL databases with MongoDB.

Text Books:

1. Tom White, "Hadoop: The Definitive Guide", 4th Edition, O'Reilly Media Inc, 2015.
2. Bill Chambers, Matei Zaharia, “Spark: The Definitive Guide”, 4th Edition, O'Reilly Media Inc, 2018
3. Tanmay Deshpande, “Hadoop Real-World Solutions Cookbook”, 2nd Edition, Packt Publishing, 2016.

Suggested Reading:

1. Edward Capriolo, Dean Wampler, and Jason Rutherglen, "Programming Hive", O'Reilly Media Inc, October 2012.
2. VigneshPrajapati, "Big data Analytics with R and Hadoop", Packt Publishing, November 2013.

Web Resources:

1. https://parthgoelblog.wordpress.com/tag/hadoop-installation
2. http://www.iitr.ac.in/media/facspace/patelfec/16Bit/index.html
3. https://class.coursera.org/datasci-001/lecture
4. http://bigdatauniversity.com

With effect from the Academic Year 2022-23

20ADC16 **PROJECT PART–I**

Instruction	4 Hours per Week
Duration of SEE	--
SEE	--
CIE	50 Marks
Credits	2

Prerequisite: Knowledge of core engineering courses, Capable of searching for suitable literature, Problem Identification and Solving.

Course Objectives:

1. The student takes up investigative study in the broad field of Engineering / Technology, involving both theoretical and practical knowledge.
2. Motivate student(s) towards Research & Development with creative problem solving.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Identify problem from literature survey in his/her area of interest
2. Formulate possible solutions for the selected problem and compare with existing ones
3. Prepare synopsis of the selected problem
4. Gather the required information to set up the environment for the implementation of preliminary experimentation
5. Communicate the work effectively in both oral and written forms

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	1	-	-	1	-	3	1	1	3	3	3	2
CO2	3	3	2	1	1	-	1	-	3	2	1	3	3	3	2
CO3	3	3	3	3	3	-	1	-	3	3	2	3	3	3	3
CO4	3	3	2	3	3	-	1	-	3	3	2	3	3	3	3
CO5	3	2	2	2	1	-	1	2	3	3	2	3	3	3	3

The work shall include:

1. Survey and study of published literature on the assigned topic
2. Preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/Modeling/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 a Departmental Research Committee.

Guidelines for the award of 50 Marks

Evaluation by	Max. Marks	Evaluation Criteria / Parameter
Supervisor	5	Regularity and Punctuality
	5	Work Progress
	5	Quality of the work
	5	Report on Project Part-1
Project Coordinator	5	Technical Content
	5	Presentation
	5	Partial Implementation
Department Review Committee	10	Project Review
	5	Conference/Journal Publication

Note:

Students are instructed to

1. Prepare an Action Plan with project work timelines.
2. Submit weekly project status reports duly signed by the supervisor.
3. Prepare a report in the specified format.
4. Present project seminars as per schedules
5. Write a Survey paper for Conference presentation/ Publication in Journals.

Open Elective- 1 (VII Semester)		
S.No.	**Course Code**	**Course Name**
1.	**20MEO03**	**Research Methodologies**
2.	**20MEO12**	**3D Printing**
3.	**20ME O15**	**Principles of Industry 4.0**
4.	**20ECO14**	**Neural Networks and Fuzzy Logic**
5.	**20EGO01**	**Technical Writing Skills**

20MEO03 **RESEARCH METHODOLOGIES**

(Open Elective-1)

Instruction	3 Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

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:

Upon successful completion of this 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 insample 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.

Text Books*:*

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 AravindShende, 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.

20MEO12 **3D PRINTING**
(Open Elective-1)

Instruction	3 Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

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:

Upon successful completion of this 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 of3Dprinter.

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. subtractivemanufacturing, its advantages and limitations

UNIT-II

Photo polymerization processes: Photo polymerization, Stereolithography Apparatus (SLA), Applications,advantages and disadvantages. **Powder bed fusion processes:** Introduction, Selective laser Sintering (SLS), Materials, Applications, advantage and disadvantages. **Extrusion-based systems:** Fused deposition modeling (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: Modeling and viewing - 3D scanning; Model preparation – STL conversion, STL error diagnostics, STL file Repairs, generic solution, slicing, newly proposed 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.

Text Books:

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, 4th edition 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.

With effect from the Academic Year 2022-23

20ME O15 **PRINCIPLES OF INDUSTRY 4.0**
(Open Elective-1)

Instruction	3 Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:
1. Understand the concept and applications of Digital Manufacturing and Industry 4.0.
2. Relate different Additive manufacturing processes as a part of Digital Manufacturing
3. Understand the concept of Virtual prototyping, digital design and Importance of reverse engineering in Digital Manufacturing
4. To understand the concept of Industry 4.0 and allied technologies.
5. To Provide an understanding on the challenges faced and relevant industrial applications of Industry 4.0

Course Outcomes:
At the end of the course, the students will be able to:
1. Understand the Basics and applications of Digital Manufacturing and Industry 4.0.
2. Understand the role of Additive Manufacturing, Virtual prototyping and Reverse Engineering processes and their adaptability to Digital Manufacturing.
3. Understand the concepts of digital manufacturing based product life cycle and its management.
4. Understand the concept of Industry 4.0 and allied technologies.
5. Understand the basics of Internet of things and cloud computing pertaining the fourth industrial revolution.

UNIT-I
Introduction to digital manufacturing: Definition of digital manufacturing, Operation Mode and Architecture of Digital Manufacturing System, Impact on manufacturing careers, Advantages of digital manufacturing and design, Information sharing in the digital thread, Digital twins and Files format (STL, AMF, 3MF), Multiple organizations in the manufacturing process. Introduction of Industry 4.0, case study on car manufacturing by Bosch.

UNIT-II
Additive Manufacturing Processes: Additive Manufacturing processes – Engineering polymers, metals and ceramics. Stereolithography, Selective Laser Sintering, Fused Deposition Modeling, Layered object manufacturing. Electronic Materials, Bio-printing, Food Printing. Preprocessing and Post processing in AM
Virtual Prototyping & Reverse Engineering: Virtual Prototyping, Applications, Virtual Prototyping and Virtual Manufacturing. Reverse Engineering, Application of Reverse Engineering in Digital Manufacturing. Self-Learning of Manufacturing System and Intelligent Manufacturing System.

UNIT-III:
Key Technology of Digital Manufacturing: Various Digital Technologies in Product Lifecycle, Digital Equipment and Digital Processing Technology, Technology of Digital Maintenance and Diagnosis.
Product life cycle management: Introduction, Types of Product Data, Product life cycle management (PLM) systems. Features of PLM System, System architecture, Product information models, Functionality of the PLM Systems.

UNIT-IV:
Industry 4.0: Various Industrial Revolutions, Compelling Forces and Challenges for Industry 4.0, Comparison of Industry 4.0 Factory and Today's Factory, automation, data exchanges, cloud, cyber-physical systems, mobile robots, Big Data, deep machine learning, Production Systems, IoT, Challenges of implementing Industry 4.0, Impact of implementing Industry 4.0 in various sectors, Applications domains and the way forward.

UNIT –V:
Internet of Things (IoT) - IoT design methods, physical devices and enabling technologies, Industrial Internet of Things (IIoT), Smart Manufacturing. **Cloud Computing and Manufacturing**- Cloud models, cloud manufacturing examples, cloud based manufacturing, Cloud service and platforms for manufacturing. Augmented Reality and Virtual Reality in Manufacturing.

Text Books: `
1 Zude Zhou, Shane (Shengquan) Xie and Dejun Chen, Fundamentals of Digital Manufacturing Science, Springer-Verlag London Limited,2012

2 Brent Stucker, David Rosen, and Ian Gibson, Additive Manufacturing Technologies, ISBN 978-1-4419-1120-9, Springer, 2010
3 Chee Kai Chua, Kah Fai Leong, 3D printing and additive manufacturing: principles and Application, 4th edition of rapid prototyping
4 Alasdair Gilchrist, Industry 4.0: The Industrial Internet of Things.

Suggested reading:

1. Lihui Wang and Andrew Yeh Ching Nee, Collaborative Design and Planning for Digital Manufacturing, Springer-Verlag London Limited, 2009
2. Venuvinod, PK; Ma, W; Rapid prototyping – Laser based and other technologies, Kluwer,2004

With effect from the Academic Year 2022-23

20ECO14 **NEURAL NETWORKS AND FUZZY LOGIC**
(Open Elective-1)

Instruction	3 Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Probability knowledge is required

Course Objectives:
1. Learn various types of neural networks
2. Learn the concepts of Fuzzy systems
3. Study the applications of neural networks and Fuzzy controllers.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Understand the principles of Neural Networks and Fuzzy Logic fundamentals.
2. Apply the basic concepts to model the Neural Networks and Fuzzy Logic systems.
3. Compare the Neural Network based systems and Fuzzy Logic based systems.
4. Analyze Fuzzy Logic controllers and its applications.
5. Explain the concepts of Fuzzy target tracing control systems.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	1	1	1	1	1	-	-	-	-	-	-	2	2	1	1
CO2	3	3	2	2	1	-	-	-	-	-	-	2	3	1	1
CO3	2	2	2	1	1	-	-	-	-	-	-	1	2	1	1
CO4	2	2	3	2	1	-	-	-	-	-	-	2	3	1	1
CO5	1	1	2	1	2	-	-	-	-	-	-	1	2	1	1

UNIT-I
Introduction: Introduction to ANS (Artificial Neural systems) Technology, ANS simulation, Types of Neural Networks: Hopfield, perceptron and related models, Adaline and Madaline: Adaline and the Adaptive Linear Combiner, the Madaline and simulating the Adaline.

UNIT-II
Probabilistic Models, Fuzzy ARTMAP and Recurrent Networks:Probabilistic Neural Networks, General Regression Neural Networks, Fuzzy ARTMAP, Recurrent Back propagation Neural Networks.

UNIT-III
Application of Neural Networks: - Design and optimization of Systems: Non-Linear optimization, Inverse design problems, Pattern Recognition Applications: Control Chart pattern Recognition, Recognition of Machine-Cells in a group technology layout. Complex pattern Recognition tasks: Pattern mapping, pattern variability.

UNIT-IV
Introduction to Fuzzy systems, Fuzzy sets and operations on Fuzzy sets, Basics of Fuzzy relations, Fuzzy measures, Fuzzy integrals, Transform Image coding with Adaptive Fuzzy systems.

UNIT-V
Fuzzy Target Tracking control systems, Fuzzy and Math Model Controllers, Real Time Target Tracking, Fuzzy Controller, Fuzzified CMAC and RBF – Network based self-learning Controllers.

Text Books:

1. James A. Freeman and David M. Skapura, "Neural Networks: Algorithms Applications and Programing Techniques", Pearson Education, India, 2008.
2. James A. Anderson, "An introduction to Neural Networks", PHI, 2003.

Suggested Readings:

1. B. Yegnanarayana, "Artificial Neural Networks", PHI Publications, India, 2006.
2. M.AnandaRao and J.Srinivas, "Neural Networks:Algorithms and Applications", Narosa Publications, 2009

With effect from the Academic Year 2022-23

20EGO01 **TECHNICAL WRITING SKILLS**

(Open Elective-1)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 marks
CIE	40 marks
Credits	3

Course Objectives:

1. Process of communication and channels of communication in general writing and technical writing in particular.
2. Learn Technical Writing including sentence structure and be able to understand and use technology specific words.
3. Write business letters and technical articles.
4. Write technical reports and technical proposals.
5. Learn to write agenda, record minutes of a meeting, draft memos. Understand how to make technical presentations.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Communicate effectively, without barriers and understand aspects of technical communication.
2. Differentiate between general writing and technical writing and write error free sentences using technology specific words
3. Apply techniques of writing in business correspondence and in writing articles.
4. Draft technical reports and technical proposals.
5. Prepare agenda and minutes of a meeting and demonstrate effective technical presentation skills.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	2	2	2	-	-	-	-
CO2	-	-	-	-	-	-	-	-		2	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	2	-	-	-	-	-	2	-	-	2	-	-	-	-
CO5	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-

UNIT-I

Communication – Nature and process. **Channels of Communication** – Downward, upward and horizontal 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 and significance, types. 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 : Preparation of agenda, participation, chairing and writing minutes of a meeting. Memorandum. Seminars, workshops and conferences.
Technical Presentations : Defining purpose, audience and locale, organizing content, preparing an outline, use of Audio Visual Aids, nuances of delivery, importance of body language and voice dynamics.

Text Books :

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

Web 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

With effect from the Academic Year 2022-23

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

Scheme of Instruction of VIII Semester of B.E. – Artificial Intelligence and Data Science as per AICTE Model Curriculum, with effective from 2022-23

DEPARTMENT OF ARTIFICIAL INTELLIGENCE & DATA SCIENCE

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		Open Elective – 2	3	-	3	40	60	3
2		Open Elective – 3	3		3	40	60	3
PRACTICALS								
3	20ADC17	Technical Seminar	-	2	-	50	-	1
4	20ADC18	Project Part -2	08 Hours per week /180 Hours Industry		-	100	100	4
TOTAL			**6**	**2**	**6**	**230**	**220**	**11**

L: Lecture T: Tutorial D: Drawing P: Practical
CIE – Continuous Internal Evaluation SEE - Semester End Examination

Open Elective- 2 (VIII Semester)			Open Elective- 3 (VIII Semester)		
S.No.	**Subject Code**	**Subject Name**	**S.No.**	**Subject Code**	**Subject Name**
1	20MEO04	Principles of Entrepreneurship	1	20MTO03	Quantum Computing
2	20BTO04	Bioinformatics	2	20MEO07	Intellectual Property Rights
3	20MEO10	Introduction to Operations Research	3	20ECO01	Remote Sensing and GIS
4	20ECO06	Principle of VLSI	4	20CEO02	Disaster Risk Reduction and Management
5	20EEO04	Energy Conservation	5	20BTO05	Cognitive Neuro Science

With effect from the Academic Year 2022-23

20ADC17 **TECHNICAL SEMINAR**

Instruction	4 Hours per Week
Duration of SEE	--
SEE	--
CIE	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.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Collect Organize, Analyze and Consolidate information about emerging technologies from the literature.
2. Exhibit effective communication skills, stage courage, and confidence.
3. Demonstrate intrapersonal skills.
4. Explain new innovations/inventions in the relevant field.
5. Prepare Seminar Report in a prescribed format.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2	3	3	3	1	2	2	2	3	3	3	3
CO2	0	2	2	1	1	3	3	1	1	3	2	3	2	0	1
CO3	3	2	2	2	1	3	3	0	1	2	1	3	3	3	3
CO4	3	2	2	2	1	3	3	0	1	2	1	3	2	0	1
CO5	3	2	1	1	2	3	3	0	1	3	2	3	2	0	1

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

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 be preferably from any peer reviewed recent journal publications.

Guidelines for awarding marks		
S. 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

With effect from the Academic Year 2022-23

20ADC18 **PROJECT PART-2**

Instruction	4 Hours per Week
Duration of SEE	--
SEE	100 Marks
CIE	100 Marks
Credits	4

Course Objectives:

1. Enable the student extend further the investigative study, either fully theoretical/practical or involving both theoretical and practical work.
2. The work shall be carried out under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry.
3. Preparing an Action Plan for conducting the investigation, including team work.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Demonstrate a sound technical knowledge of their selected topic.
2. Conduct investigations by using research-based knowledge and methods to provide valid conclusions.
3. Provide solutions to societal complex problems utilizing gained engineering knowledge as an individual or by team work.
4. Create/select/use modern tools to overcome the limitation of complex engineering solutions.
5. Communicate with engineering experts and the community at large in written and oral forms.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	0	0	0	1	0	3	1	2	3	3	3	2
CO2	3	3	2	0	0	0	1	0	3	1	2	3	3	3	2
CO3	3	3	3	3	3	0	1	0	3	1	2	3	3	3	3
CO4	0	3	1	3	3	0	1	0	3	3	2	3	3	3	3
CO5	0	1	0	2	3	0	1	3	3	3	1	2	3	3	2

Note:

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

Guidelines for awarding 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	20	PowerPoint Presentation
	40	Thesis Evaluation
	20	Quality of the project ● Innovations ● Applications ● Live Research Projects ● Scope for future study ● Application to society
	20	Viva-Voce

Open Elective- 2 (VIII Semester)		
S.No.	**Subject Code**	**Subject Name**
1	**20MEO04**	**Principles of Entrepreneurship**
2	**20BTO04**	**Bioinformatics**
3	**20MEO10**	**Introduction to Operations Research**
4	**20ECO06**	**Principle of VLSI**
5	**20EEO04**	**Energy Conservation**

With effect from the Academic Year 2022-23

20MEO04 **PRINCIPLES OF ENTREPRENEURSHIP**

(Open Elective-2)

Instruction	3 Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

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:

Upon successful completion of this 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

Behavioral 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 .

Text Books:

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, 5th edition, Tata Mc Graw Hill Publishing Company Ltd., 2005.
2. Stephen R. Covey and A. Roger Merrill, First Things First, Simon and Schuster Publication,1994.

With effect from the Academic Year 2022-23

20BTO04 **BIO-INFORMATICS**

(Open Elective-2)

Instruction	3 Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisites: The school level basic knowledge in Fundamental science is required.

Course Objectives:

1. To provide elementary knowledge in biology and bioinformatics and biological information available to a biologist on the web and learn how to use these resources on their own.
2. To learn the fundamentals of biological databases, Sequence analysis, data mining, sequence alignment and phylogenetic.
3. To learn methods for determining the pre dictinggene and protein.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Explain the basic concepts of biology and bioinformatics.
2. Identify various types of biological databases used for the retrieval and analysis of the information.
3. Explain the sequence analysis and data mining.
4. Discuss the methods used for sequence alignment and construction of the phylogenetic tree.
5. Describe the methods used for gene and protein structure prediction.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	0	0	0	0	0	0	0	0	1	0	1
CO2	1	1	0	1	1	0	0	0	0	1	0	1
CO3	2	0	0	1	1	0	0	0	0	1	0	1
CO4	2	0	0	1	1	0	0	0	0	1	0	1
CO5	2	1	0	1	1	0	0	0	0	1	0	1

UNIT-I

Introduction And Basic Biology: Bioinformatics- Introduction, Scope and Applications of Bioinformatics; Basics of DNA, RNA, Gene and its structure, Protein and metabolic pathway; Central dogma of molecular biology; Genome sequencing, Human Genome Project.

UNIT-II

Biological Databases: Introduction to Genomic Data and Data Organization, types of databases, biological databases and their classification, Biological Databases - NCBI, SWISS PROT/Uniport, Protein Data Bank, Sequence formats; Information retrieval from biological databases; Data mining of biological databases.

UNIT-III

Sequence Analysis and Data Mining: Scoring matrices, Amino acid substitution matrices- PAM and BLOSUM; Gap, Gap penalty; Database similarity searching - BLAST, FASTA algorithms to analyze sequence data, FASTA and BLAST algorithms comparison; 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.

UNIT-IV

Sequence Alignment And Phylogentics: Sequence Alignment – Local and Global alignment; Pairwise sequence alignment – Dynamic Programming method for sequence alignment - Needleman and Wunsch algorithm and Smith Waterman algorithm. Multiple sequence alignment - Methods of multiple sequence alignment, evaluating multiple alignments, applications of multiple sequence alignment. Concept of tree, terminology, Methods of phylogenetic analysis, tree evaluation – bootstrapping, jackknifing.

UNIT-V.

Macromolecular Structure Prediction:
Gene prediction, - neural networks method, pattern discrimination methods, conserved domain analysis; Protein structure basics, protein structure visualization, Secondary Structure predictions; prediction algorithms; Chou-Fasman and GOR method, Neural Network models, nearest neighbor methods, Hidden-Markov model, Tertiary Structure predictions; prediction algorithms; homology modeling, threading and fold recognition, ab initio prediction.

Text Books:

1. David Mount, "Bioinformatics Sequence and Genome Analysis", 2nd edition, CBS Publishers and Distributors Pvt. Ltd., 2005
2. Rastogi SC, Mendiratta N and Rastogi P, "Bioinformatics: Methods and Applications Genomics, Proteomics and Drug discovery", 3rdedition, PHI Learning Private Limited, New Delhi, 2010

Suggested Reading:

1. Baxebanis AD and Francis Ouellette BF, "Bioinformatics a practical guide the analysis of genes and proteins", 2nd edition, John Wiley and Sons, Inc., Publication, 2001.
2. Vittal R Srinivas, "Bioinformatics: A modern approach. PHI Learning Private Limited", New Delhi, 2009.
3. JiXiong, "Essential Bioinfomatics", Cambridge University Press, 2006.

With effect from the Academic Year 2022-23

20MEO10 INTRODUCTION TO OPERATIONS RESEARCH
(Open Elective -2)

Instruction	3 Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

1. Students will come to know the formulation of LPP models.
2. Students will understand the Algorithms of Graphical and Simplex Methods.
3. Students will understand the Transportation and Assignment techniques.
4. Students will come to know the procedure of Project Management along withCPM and PERT techniques.
5. Students will understand the concepts of sequencing.

Course Outcomes:

At the end of the course, the students are able to

1. Understand the concepts of linear programming problem.
2. Solve the given transportation problem.
3. Develop optimum pair of operations and resources by using assignment technique.
4. Analyze project management techniques like CPM and PERT to plan and execute projects successfully.
5. Apply sequencing concepts for industry applications.

UNIT-I

Introduction: Definition and scope of operations research.

Linear programming: Introduction, formulation of linear programming problems, graphical method ofsolving LP problem, simplex method, degeneracy in simplex method.

UNIT-II

Transportation models: Finding an initial feasible solution - north west corner method, least cost method, vogel‘s approximation method, finding the optimal solution, special cases in transportation problems - unbalanced transportation problem, degeneracy in transportation.

UNIT-III

Assignment techniques: Introduction, Hungarian technique of assignment techniques, unbalanced problems, problems with restrictions, maximization in assignment problems, travelling salesman problems.

UNIT-IV

Project management: Definition, procedure and objectives of project management, differences between CPM and PERT , rules for drawing network diagram, scheduling the activities, Fulkerson‘s rule, earliest and latest times, determination of ES and EF times in forward path, LS & LF times in backward path, determination of critical path, duration of the project.

UNIT-V

Sequencing models: Introduction, general assumptions in sequencing, sequencing rules processing n" jobs through two machines, processing n" jobs through three machines.

Text Books:

1. Hamdy A. Taha, Operations Research-An Introduction, 10th edition, Pearson education edition, 2017.
2. S.D. Sharma, Operations Research, Kedarnath, Ramnath & Co., Meerut, 2009.
3. V.K. Kapoor, Operations Research, S. Chand Publishers, New Delhi, 2004.

Suggested Reading:

1. R. Paneerselvam, Operations Research, 2nd edition, PHI Learning Pvt. Ltd., New Delhi, 2008.
2. Nita H. Shah, Ravi M. Gor, Hardik Soni, Operations Research, PHI Learning Private Limited, 2013.

With effect from the Academic Year 2022-23

20ECO06 **PRINCIPLES OF VLSI**
(Open Elective-2)

Instruction	3 Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Basic Electronics and Digital Logic Fundamentals are required

Course Objectives:
1. To study various characteristics of MOS transistor.
2. To learn various concepts required to obtain the digital logic layout diagrams.
3. To learn various memory design concepts.
4. To study various VLSI Fabrication process steps.

Course Outcomes:
Upon successful completion of this course, students will be able to:
1. Understand characteristic behavior of MOSFET
2. Describe various MOS layers and layout design rules.
3. Implement various CMOS logic circuits.
4. Design various MOS memories.
5. Understand the concepts of VLSI technology.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	-	-	-	-	-	-	-	2	1	1	1
CO2	1	1	2	1	-	-	1	1	-	-	-	2	2	2	2
CO3	1	2	1	1	1	-	1	1	-	-	-	2	2	2	2
CO4	1	2	1	-	1	-	1	1	-	-	-	2	2	2	1
CO5	-	1	-	1	-	-	-	1	-	-	-	2	1	1	1

UNIT – I

Introduction to MOS Technology: Basic MOS Transistor action. Enhancement and Depletion Modes. Basic electrical properties of MOS. Threshold voltage and Body Effect.

UNIT-II

MOS and CMOS circuit Design Process: N-Well, P-Well and Twin-Tub process. MOS Layers, Stick diagrams, Lambda based Design rules and Layout diagrams.

UNIT- III

CMOS Design: Design of MOS inverters with different loads. Basic Logic Gates with CMOS: INVERTER, NAND, NOR, AOI and OAI gates. Transmission gate logic circuits, BiCMOS inverter, D flip flop using Transmission gates.

UNIT- IV

Memories: Design of Dynamic Register Element, 3T, 1T Dynamic RAM Cell, 6T Static RAM Cell. NOR and NAND based ROM Memory Design.

UNIT-V

Introduction to VLSI Technology and Fabrication Process: Various layers of IC, Wafer preparation and crystal growth, Oxidation, CVD, Lithography, Etching, Ion implantation, Diffusion techniques.

Text Books:

1. Kamran Eshraghian, Douglas A. Pucknell, SholehEshraghian, "Essentials of VLSI circuits and systems", PHI, 2011.
2. Neil H E Weste, David Harris, Ayan Banerjee "CMOC VLSI Design –A circuit and System Perspective", 3/e, Pearson Education, 2006.
3. J.D.Plummer, M.D.Deal and P.B.Griffin, "The Silicon VLSI Technology Fundamentals", Practice and modeling, Pearson Education 2009.

Suggested Reading:

1. John P. Uyemura, "Introduction to VLSI Circuits and systems", John Wiley & Sons, 2011.
2. Simon Sze" VlSI Technology, 2/E", McGraw-Hill Education (India) Pvt Limited-2003

With effect from the Academic Year 2022-23

20EEO04 **ENERGY CONSERVATION**

(Open Elective-2)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
CIE	40 Marks
Credits	3

Prerequisites: Students should have prior knowledge on Fundamentals of power systems, electrical machines, and power electronics.

Course Objectives:

1. To know the concept of Energy conservation
2. To understand the formulation of efficiency for various engineering systems
3. To explore the different ways to design various technologies for efficient engineering systems.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Know the current energy scenario and importance of energy conservation.
2. Understand the concepts of energy conservation.
3. Evaluate the performance of existing engineering systems.
4. Explore the methods of improving energy efficiency in different engineering systems.
5. Understanding different energy efficient devices.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2		2		2									
CO2	3	2		3		1									
CO3	3	3	2	3	2	2							2	1	
CO4	3	2	2	2	2	1							2	1	
CO5	2	2	1	2	2	1									

UNIT-I

Basics of Energy and its various forms: Overview of engineering elements, Solar energy, electricity generation methods using solar energy, PV cell, elements of wind energy, electricity generation using wind energy, elements of bioenergy, biomass energy conservation, sources of chemical energy, fuel cells, Energy Scenario in India.

UNIT-II

Energyconservation-1: Domestic Sector: Energy conservation needs and objectives, energy conservation strategies in domestic sector, energy conservation tips in the kitchen, other energy saving tips in the domestic house, energy conservation measures in office, energy conservation processes/activities for a building. HVAC (heating, ventilation, air conditioning), components of HVAC, energy conservation opportunities in HVAC systems.

UNIT-III

Energy conservation-2: Industrial Sector: Energy conservation in Indian industrial sector, energy saving potential in industry: boiler, furnaces, air compressors, refrigeration systems, heat exchanger, heat pump, turbines, electric drives, pumps, cooling towers, fans and blowers.

Energy conservation in agriculture sector: Energy conservation opportunities in pumps used in agriculture sector, summary.

UNIT-IV

Energy Efficient Technologies-I: Importance of energy efficiency for engineers, Energy efficient technology in mechanical engineering: Heating, ventilation and air-conditioning, boiler and steam distribution systems. Energy efficient technology in civil engineering: future of roads, harnessing road and transport infrastructure; Energy efficient technology in agriculture: IoT and Drone Technology.

UNIT-V

Energy Efficient Technologies-II: Energy efficient technology in electrical engineering: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors; Energy efficient technology in chemical engineering: green chemistry, low carbon cements, recycling paper. Green buildings concept.

Text Books:

1. Umesh Rathore, "Energy management", Kataria publications, 2nd ediiton,2014.
2. Guide books for National Certification Examination for Energy Manager/EnergyAuditorsBook-1, General Aspects
3. Hargroves,K., Gockowiak,K., Wilson,K., Lawry,N., and Desha,C. (2014) "An Overview of Energy Efficiency" , opportunities in Mechanical/civil/electrical/chemical Engineering, The University of Adelaide and Queensland University of Technology.

Open Elective- 3 (VIII Semester)		
S.No.	**Subject Code**	**Subject Name**
1	**20MTO03**	**Quantum Computing**
2	**20MEO07**	**Intellectual Property Rights**
3	**20ECO01**	**Remote Sensing and GIS**
4	**20CEO02**	**Disaster Risk Reduction and Management**
5	**20BTO05**	**Cognitive Neuro Science**

With effect from the Academic Year 2022-23

20MTO03 **QUANTUM COMPUTING**

(Open Elective-3)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

1. To learn Quantum bits and compute mathematical foundation
2. To understand the evaluation of the quantum bits.
3. To learn Quantum operations by building blocks of Quantum programming
4. To know the basics of Quantum logic gates and circuits
5. To learn Quantum Algorithms by various Techniques.

Course Outcomes:

Upon completion of this course, students will be able to:

1. Compute basic mathematical operations on Quantum bits.
2. Will be able to execute Quantum operations of Quantum computing
3. To built quantum programs
4. Develop quantum Logical gates and circuits.
5. Develop the quantum algorithm

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	0	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	2	0	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	2	0	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	2	2	-	-	-	-	-	2	-	-	-	2	2
CO5	2	2	2	2	-	-	-	-	-	2	2	-	-	2	2

UNIT-I:

Math Foundation for Quantum Computing: Introduction of Vector Space, Subspaces, Basis and Finite Dimensions. Vectors and orthogonality, inner product and Outer product and Hilbert Spaces. Formation of Matrices by Linear Transformation. Linear Independent and dependent Vectors. Unitary operators and projectors, Eigen values and Eigen Vectors.

UNIT-II:

Introduction to Quantum Computing: Quantum Mechanics (Huygens wave theory ,Photo electric effect De-Broglie hypothesis and Heisenberg's uncertainty Principle), Origin of Quantum Computing, Overview of major concepts in Quantum Commuting ,Qubits and multi-qubits states, Bra-ket notation, Quantum Superposition Motivation for Studying Quantum Computing, Major players in the industry (IBM, Microsoft, Rigetti, D-Wave.

UNIT-III:

Building Blocks for Quantum Program: Block sphere representations, Multi-qubits, Inner and outer product of Multiple of qubits, Tensor product, Quantum Entanglement, Quantum Teleporation (EPR Model) and Bell State.

UNIT-IV:

Quantum Logical gates and Circuits: Pauli, Hadamard, Phase shift, controlled gates, AND, OR and NAND gate, C-Not, CCNOT gate Introduction of Fourier Transform and Discrete Fourier transform.

UNIT-V:

Quantum Algorithms: Z-Transform. Basic techniques exploited by quantum algorithms (Amplitude amplification, Quantum Fourier Transform, Quantum Phase estimation, Quantum walks), Major Algorithms (Shore's Algorithm, Grover's Algorithm, Deutsch's Algorithm, Deutsch-Jozsa Algorithm).

Text Books:

1. Michael A. Nielsen, "Quantum Computation and Quantum Information", Cambridge University Press.
2. David McMahon, "Quantum Computing Explained", Wiley.

With effect from the Academic Year 2022-23

20MEO07 **INTELLECTUAL PROPERTY RIGHTS**

(Open Elective-3)

Instruction	3 Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives:

1. Fundamental aspects of IP.
2. Salient features of IPR acts.
3. The methods of registrations of Intellectual property.
4. Awareness for innovation and its importance of protection.
5. The changes in IPR culture and techno-business aspects of IPR.

Outcomes:

Upon successful completion of this course, students will be able to:

1. Understand the evolution of IP, working of organization's at global level to protect and promote IP.
2. Familiarize with the patent filing process at national and international level.
3. Draw the logical conclusion of research, innovation and patent filing.
4. Compare different kinds of IP and their patenting system.
5. Understand the techno-legal-business angle of IP, infringement and enforcement mechanisms forprotection.

UNIT-I

Introduction: Definition of intellectual property, the need for intellectual property rights (IPR), kinds of intellectual property rights, IPR in India – genesis and development, IPR abroad, importance of WTO, TRIPS agreement, patent cooperation treaty, Berne and universal copyright conventions.

UNIT-II

Patents: Definition of patent, commercial significance , term of patent, patentable subject- matter, rights and obligations of patentee, searching of existing patents, drafting of patent, specification of patent, filing of a patent, the different layers of the patent system (national, regional and international options), compulsory licensing and licenses of rights, revocation of patents, differences between utility model and patent.

UNIT-III

Industrial designs: Definition of designs, registration of design, rights and duties of proprietor of design,piracy of registered design.

Trademarks: Meaning of trademarks, purpose of protecting trademarks, registration of trademarks, passingoff, assignment and licensing of trademarks, infringement of trademarks.

Geographical indications: Definition, differences between GI and trademarks.

UNIT-IV

Copy right: Nature and scope of copy right, term of copyright, subject matter of copyright, rights conferred by copyright ,publication, broad casting, telecasting, computer program, database protection, assignment and transmission of copyright, infringement of copy right trade secrets and know-how agreement.

UNIT-V

Enforcement of intellectual property rights: Infringement of intellectual property rights, enforcement measures, emerging issues in intellectual property protection, case studies of patents and IP Protection.

Unfair competition: What is unfair competition, relationship between unfair competition and intellectualproperty laws.

Text Books:

1. Ajit Parulekar and SaritaD'Souza, Indian Patents Law – Legal & Business Implications, Macmillan India Ltd., 2006.
2. B.L.Wadehra, Law relating to Patents, Trade Marks, Copyright, Designs &Geographical Indications, Universal law Publishing Pvt Ltd., India, 2000.
3. P.Narayanan, Law of Copyright and Industrial Designs; Eastern law House, New Delhi, 2010.

Suggested readings:

1. CronishW.R, Intellectual Property Patents, Copyright, Trade Marks and Allied rights,Sweet & Maxwell,1993.
2. P.Narayanan, Intellectual Property Law, Eastern Law Edn., 1997.

20ECO01 **REMOTE SENSING and GIS**
(Open Elective-3)

Instruction	3 Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Basic knowledge of Geography is required

Course Objectives:
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:
Upon completion of this 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 Microwave remote sensing techniques
5. Explain the procedure for encoding data and geospatial data analysis.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PSO2**	**PSO3**
CO1	3	1	1	1	–	1	1	1	--	1	--	2	1	--	--
CO2	3	1	1	1	–	1	1	1	--	1	--	2	1	--	--
CO3	3	1	1	1	–	1	1	1	--	1	--	2	1	--	--
CO4	2	1	1	1	–	1	1	1	--	1	--	2	1	--	--
CO5	3	1	1	1	–	1	1	1	--	1	--	2	1	--	--

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.

Text Books:

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.

With effect from the Academic Year 2022-23

20CEO02 DISASTER RISK REDUCTION AND MANAGEMENT

(Open Elective-3)

Instruction	3 Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Outcomes:

Upon completion of this course, the student will be able to,

1. Identify and understand the concepts of hazards, causes and impacts of disasters.
2. Develop a critical capacity to evaluate the principles and practices of disaster risk reduction and management.
3. Develop a deep awareness of disaster resilience, risk mitigation, and recovery policies as they arise from natural hazards around the globe.
4. Apply knowledge about existing global frameworks and existing agreements and role of community in successful Disaster Risk Reduction.
5. Evaluate DM study including data search, analysis and presentation as a case study.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	2	2	2	2	1	2	2	2	1	1	1	1
CO2	1	1	2	2	2	3	3	1	2	1	1	1	1	1	
CO3	2	2	2	2	2	2	3	2	1	1	2	1	1		
CO4	2	2	2	2	3	2	1	1	1	1	1	1			
CO5	2	1	2	1	2	3	1	2	2	2	2	1	1	1	1

UNIT-I

- Hazard and disaster-concepts, vulnerability and risk
- Hazard and disaster type – Natural, Water- related, Pandemic and Human induced hazards disasters
- Causes and Impacts of disasters – Impacts on natural eco systems: physical, psychological and social impact
- Disaster and financial resilience
- GIS and remote sensing
- Disaster vulnerability profile of India –Specific to geographical regions and states (as per regional significance)

UNIT-II

- Disaster Management Cycle –Rescue, Relief, Rehabilitation, Prevention, Mitigation and Preparedness
- Disaster risk reduction {DRR) –Community based DRR, institutions concerned with safety, disaster mitigation and construction techniques as per Indian standards
- Early warning systems

UNIT-III

- Trauma and stress management
- First aid and emergency procedures
- Awareness generation strategies for the community on safe practises in disaster (as per regional significance)

UNIT-IV

- Components of disaster management –preparedness of rescue and relief, mitigation, rehabilitation &reconstruction
- Institutional frame work of disaster management in India (NDMA-SDMA, NDRF, Civic volunteers, NIDM)
- Phases of disaster/risk management and post-disaster responses
- Compensation and insurance
- Applications of remote sensing &GIS in disaster management

UNIT-V

- Capacity building for disaster/damage mitigation (structural and non structural measures).
- Disaster risk reduction strategies and national disaster management guidelines
- Disaster management Act -2005
- Regional issues as per regional requirement/university can take minimum two topics as per high powered committee

Text Books:

1. Singh, R. (2017), "Disaster management Guidelines for Earth quakes, Landslides, Avalanches and Tsunami". Horizon Press publications.
2. Taimpo (2016), "Disaster managementand preparedness". CRC Press Publications
3. Nidhi, G.D. (2014), "Disaster management preparedness" .CBS Publications Pvt. Ltd.
4. Gupta, A.K.,Nair, S.S., Shiraz, A. and Dey, S. (2013), "Flood Disaster Risk Management-CBS Publications Pvt Ltd.
5. Singh, R. (2016), "Disaster management Guidelines for Natural Disasters" Oxford University Press Pvt. Ltd.

With effect from the Academic Year 2022-23

20BTO05 **COGNITIVE NEURO SCIENCE**

(Open Elective-3)

Instruction	3 Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisites:

The school level basic knowledge in Fundamental science is required.

Course Objectives: The main objectives of this course are to:

1. Understanding the brain effects that give rise to our abilities to perceive, act and think
2. Gain skills on the way that cognition is associated with neural activity
3. Compare and contrast the organization and function of numerous systems within the brain

Course Outcomes: At the end of the course, students will be able to:

1. Gain familiarity and basic knowledge about brain systems and functions.
2. Understand brain's neuro-transimitter system.
3. Understanding the brain's methods gives rise to behaviour whether we engage in any activity (e.g., walking, talking, etc.).
4. Identify the patterns of varied activities in neurons that correspond to a person's attempts to move in particular ways.
5. Understand the feedback system and brain disorders.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	0	2	0	0	0	2	0	3
CO2	1	1	1	1	0	2	0	0	0	2	0	3
CO3	1	1	1	1	0	2	0	0	0	2	0	3
CO4	1	2	2	3	3	3	0	3	1	3	0	3
CO5	1	1	2	3	3	3	0	3	1	3	0	3

UNIT-I

Introduction to neuroscience: Outline of neuroanatomical; Neurogenesis, migration Axon path-finding; cell death; Role of neural activity in development; Membranes and membrane potentials.

UNIT-II

Action potential: Conductance mechanisms; Chemical and electrical transmission; Postsynaptic potentials; neural integration; Energy consumption in the brain; Attention; Methods jigsaw; Executive Control; Evolution/development; Sheep's brain dissection.

UNIT-III

Neurotransmitter systems: Visual information processing; Visual cortex; Visual plasticity; critical periods; Somatosensory system; Pain; Chemoreception; Auditory system; Spinal mechanisms; Brain mechanisms.

UNIT-IV

Human and Animal Memory: Pattern completion and separation; LTP and synapses; Spatial cognition; Social cognition; Cellular mechanisms of neural plasticity.

UNIT-V

Feedback System and Brain Disorders: Endocrine systems; feeding behaviour, Stress, Addiction, Depression, Schizophrenia, Alzheimer's, Huntington's disease, Parkinson's disease.

Text books:

1. Principles of Neural Science, 6th Edition (2021) Eric R. Kandel, James Harris Schwartz, Thomas M. Jessell, McGraw Hill.
2. Principles of Cognitive Neuroscience, 2nd Edition (2013) Dale Purves, Roberto Cabeza, Scott A. Huettel, Kevin S. LaBar, Michael L. Platt, and Marty G. Woldorff. Sinauer Associates, Inc.
3. Mark Bear, Brian Connors, and Michael Paradiso (2007) Neuroscience: Exploring the Brain. 3rd ed. Baltimore: Lippincott, Williams & Wilkins.