



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.N o | 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 | 20EE004 | Energy Conservation | 5 | 20BTO05 | Cognitive Neuro Science |

| | |
|-----------------|------------------|
| 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 |

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 <ul style="list-style-type: none"> • 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 |

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.

20BT004

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 Phylogenetics: 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", 3rd edition, PHI Learning Private Limited, New Delhi, 2010

Suggested Reading:

1. Baxevanis 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 Bioinformatics", Cambridge University Press, 2006.

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 with CPM 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 of solving 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.

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, Sholeh Eshraghian, “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

20EE004**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 edition, 2014.
2. Guide books for National Certification Examination for Energy Manager/Energy Auditors Book-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 |

20MT003**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 Computing ,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 Teleportation (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.

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 for protection.

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, passing off, 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 intellectual property laws.

Text Books:

1. Ajit Parulekar and Sarita D'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. Cronish W.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.

20CE002**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.

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-transmitter 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.