R22-A

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

AICTE Model Curriculum R 22-A with effect from AY 2027-28

B.E. CSE (Artificial Intelligence and Machine Learning)

SEMESTER – VII

S. No	Course Code	Category	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	22CAC17N	PCC	Optimization Techniques for Machine Learning	3	-	-	3	40	60	3
2	22****	PEC	Professional Elective – III	3	-	-	3	40	60	3
3	22****	PEC	Professional Elective-IV	3	-	-	3	40	60	3
4	22****	OE	Open Elective-II	3	-	-	3	40	60	3
5	22EGM01	AU	Indian Constitution and Fundamental Principles	2	-	-	2	-	50	Non Credit
PRACTICAL										
6	22CAE***	PEC	Professional Elective-IV Lab	-	-	3	3	50	50	1.5
7	22CAC18N		Technical Seminar	-	-	2	-	50	-	1
8	22CAC19N		Project Part - I	-	-	4	-	50	-	2
TOTAL				**14**	**-**	**9**	**-**	**310**	**340**	**16.5**

L: Lecture **T: Tutorial** **P: Practical**

CIE – Continuous Internal Evaluation **SEE - Semester End Examination**

PE3(T) Semester-VII		PE4(T&L) Semester-VII		Open Elective – II	
22CAE06N	Cognitive Computing	22CAE08N(T)& 22CAE09N(L)	Reinforcement Learning	22EEO01	Energy Management System
22CAE07N	Nature Inspired Computing	22CIE56(T)& 22CIE58(L)	Cyber Security Attacks & Defenses	22EGO02	Gender sensitization
22CSE10N	Software Project Management	22ITE11(T)& 22ITE12(L)	Devops Tools	22MEO03	Corporate Organizational Behaviour
22CSE25	Cloud Computing Essentials	22ITE13(T)& 22ITE14(L)	Unmanned Aerial Vehicles	22CHO04	Environmental and sustainable Development
22ITE024	Computer Vision	22ADE14(T)& 22ADE15(L)	Generative AI	22MEO06	Principles of Entrepreneurship and Startups

22CAC17N

OPTIMIZATION TECHNIQUES FOR MACHINE LEARNING

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

Course Objectives: The objectives of this course are

1. Understand various Optimization Techniques Fundamentals.
2. Understand various Local and Global Optimization Techniques.
3. Understand various Gradient descent optimization in machine learning.
4. Understand usage of stochastic methods and Optimization for Neural Networks.
5. Understand various applications of Optimization for Machine learning.

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

1. Understand the fundamentals of optimization, manipulate and analyse of the optimization.
2. Demonstrate key concepts from Machine learning for Optimization to describe Optimization functions.
3. Demonstrate the Optimization with Local and Global.
4. Make use of the Gradient Descent and Stochastic Optimization Algorithms.
5. Understand different applications of Machine learning for Optimization.

CO-PO & PSO Articulation Matrix

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

Unit- I

Introduction to optimization: Introduction, History, Optimization Process, Constraints, Critical Points, Conditions for Local Minima, Derivatives and Gradients, Local Descent.

Basics of Linear Algebra and Calculus

Subspaces, Eigenvalue Decomposition and Singular Value Decomposition

Unit- II

Machine learning for Optimization

What is Function Optimization, Optimization and Machine Learning, How to Choose an Optimization Algorithm, No Free Lunch Theorem for Machine Learning, Local Optimization vs. Global Optimization, Premature Convergence, Creating Visualization for Function Optimization.

Unit- III

Local Optimization

What is a Gradient in Machine Learning? Univariate Function Optimization, Pattern Search: Nelder-Mead Optimization Algorithm, Second Order: The BFGS and L-BFGS-B Optimization Algorithms.

Global Optimization

Simple Genetic Algorithm, Evolution Strategies, Differential Evolution and Simulated Annealing.

UNIT-IV

Gradient Descent

Gradient Descent Optimization, Gradient Descent with Momentum, Gradient Descent with AdaGrad, Gradient Descent with RMSProp, Gradient Descent with Adadelta, Adam Optimization Algorithm.

Stochastic Optimization Algorithms: Introduction, Stochastic Hill Climbing, Iterated Local Search, Random Search and Grid Search.

UNIT-V

Case Study on Machine learning for optimization:

Use Optimization Algorithms to Manually Fit Regression Models, Optimize Neural Network Models, Feature Selection using Stochastic Optimization and Optimize Machine Learning Model Hyperparameters.

Text Books / Suggested Reading:

1. Mykel J. Kochenderfer and Tim A. Wheeler, Algorithms for Optimization, MITPress,2019
2. Optimization for Machine Learning (Jason Brownlee), Machine Learning Mastery.
3. Linear Algebra and Learning from Data, Gilbert Strang.
4. Optimisation for Machine Learning by Suvrit Sra, MIT Press.

Online Resources:

Optimisation for Machine Learning: Theory and Implementation
https://onlinecourses.nptel.ac.in/noc23_cs64/preview

22CAE06N

COGNITIVE COMPUTING
(Professional Elective - III)

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

Pre-requisites: NIL

Course Objectives:

1. To explore the important aspects of Cognitive science methods and paradigms.
2. To utilize the advanced algorithms with human interaction feedback mechanisms that support human reasoning.
3. To Assess the real-world systems by analyzing the impact of cognitive systems

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

1. Understand the basic cognitive concepts of AI and ML that differentiates with traditional approaches
2. Devise the development stages of cognitive architectures
3. Analyze the primary techniques and tools related to cognitive computing
4. Design Models using cognitive computing frameworks for real world requirements.
5. Solve the complex problems using cognitive computing.

CO-PO & PSO Articulation Matrix

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

UNIT-I

Introduction to Cognitive Computing:

Cognitive Science and Cognitive Computing, Nature of Cognition, Aspects of modeling, Cognitive Systems, Levels of abstraction, Emergent and Cognitivist Perspective, Connectionist models, Applications of Cognitive Computing.

UNIT-II

Cognitive Architectures

Logic based computational model, Social interaction, Architectures: ACT-R, SOAR, Opencog, Copycat, Memory networks, Classical and formal model , Causality, Categorization, Similarity and role of analogy.

UNIT-III

Design Principles: Components of a cognitive system – Building the corpus – Bridging data into cognitive NLP and Knowledge representation in Cognitive System:The Role of NLP in a Cognitive System, Semantic Web, Technologies to Business Problems, Models for knowledge representation.

UNIT–IV

Advanced Analytics

Introduction to Big Data Analytics – Predictive Analytics, Image Analytics, Speech Analytics, Using Advanced Analytics to Create Value, Building Value with In-memory Capabilities, Impact of Open-Source Tools.

UNIT–V

Building Cognitive Applications

Emerging Platforms, Defining the domain, understanding the intended users, Defining their Attributes, defining questions and exploring insights, Corpora.

Case studies: Cognitive assistant for visually Impaired, Cognitive systems in Smart cities, Cognitive systems in Healthcare.

Text Books:

1. Hurwitz, Kaufman and Bowles, Cognitive computing and Big Data Analytics", 1st Edition, Wiley, Indianapolis, IN 2015.
2. Vernon, David, " Artificial cognitive systems: A primer, 1st Edition, MIT Press, 2024

Suggested Reading:

1. Peter Fingar, " Cognitive Computing : A Brief Guide for Game changers", PHI Publication 2015.
2. Gerardus Blokdyk, Cognitive Computing Complete self-Assessment Guide", 2018.

22CAE07N

NATURE INSPIRED COMPUTING
(Professional Elective-III)

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

Course Objectives: The objectives of this course are,

1. To explore Knowledge on significance of intelligence.
2. To understand Genetic algorithms and applications.
3. To understand various Optimization technique models.

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

1. Understand various bio inspired models
2. Familiar with Genetic algorithm and its applications.
3. Explore different Ant Colony Optimization algorithmic models.
4. Compare different Artificial Bee Colony Optimization algorithmic models.
5. Apply Nature inspired techniques to real time applications.

CO-PO & PSO Articulation Matrix

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

UNIT - I:
Models of Life and Intelligence - Fundamentals of bio-inspired models and bio-inspired computing. Evolutionary models and techniques, Swarm models and its self-organization, swarm and evolutionary algorithms. Optimisation problems – single and multi-objective optimisation, heuristic, meta-heuristic and hyper heuristic functions.

UNIT - II:
Genetic algorithms - Mathematical foundation, Genetic problem solving, crossover and mutation. genetic algorithms and Markov process, applications of genetic algorithms

UNIT - III:
Ant Colony Algorithms - Ant colony basics, hybrid ant system, ACO in combinatorial optimisation, variations of ACO, case studies.

UNIT - IV:
Particle Swarm algorithms - particles moves, particle swarm optimisation, variable length PSO, applications of PSO, case studies. Artificial Bee Colony algorithms - ABC basics, ABC in optimisation, multi-dimensional bee colony algorithms, applications of bee algorithms, case studies.

UNIT - V:
Selected nature inspired techniques-Hill climbing, simulated annealing, Gaussian adaptation, Cuckoo search, Firey algorithm, SDA algorithm, bat algorithm, case studies. Other nature inspired techniques- Social spider algorithm, Cultural algorithms, Harmony search algorithm, Intelligent water drops algorithm, Artificial immune system, Flower pollination algorithm, case studies.

TEXT BOOKS:

1. Albert Y.Zomaya - "Handbook of Nature-Inspired and Innovative Computing", Springer,2006
2. Floreano, D. and C. Mattiussi-"Bio-Inspired Artificial Intelligence: Theories, methods, and Technologies" IT Press,2008

REFERENCES:

1. Leandro Nunesde Castro-"Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group,2007.
2. Marco Dorrigo, Thomas Stutzle -" Ant Colony Optimization", Prentice Hall of India, New Delhi, 2005.
3. Vinod Chandra S S, Anand H S - "Machine Learning: A Practitioner's Approach", Prentice Hall of India, New Delhi,2020

22CSE10N

SOFTWARE PROJECT MANAGEMENT
(Professional Elective-III)

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

Prerequisite: Software engineering

Course Objectives: This course aims to:

1. Develop a comprehensive understanding of software project management frameworks
2. Build practical skills in planning, risk management, and quality assurance
3. Understand and apply organizational and human resource management principles

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

1. Analyze and apply software process maturity models and frameworks
2. Develop and manage effective project activity plans and risk management strategies
3. Analyze and apply organizational structures and project control mechanisms
4. Effectively manage human resources in software projects
5. Plan, execute, and control software projects by applying principles of software configuration management, quality assurance, and risk analysis.

CO-PO & PSO Articulation Matrix

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

UNIT - I

Software Process Maturity Software maturity Framework, Principles of Software Process Change, Software Process Assessment, The Initial Process, The Repeatable Process, The Defined Process, The Managed Process, The Optimizing Process. Process Reference Models Capability Maturity Model (CMM), CMMI, PCMM, PSP, TSP)

UNIT - II

Activity Planning and Risk Management: Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling -Network Planning models – Formulating Network Model – Forward Pass and Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning - Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.

UNIT - III

Project Organizations Line-of- business organizations, project organizations, evolution of organizations, process automation. Project Control and process instrumentation, The seven-core metrics, management indicators, quality indicators, life-cycle expectations, Pragmatic software metrics, metrics automation.

UNIT - IV

Staffing in Software Projects: Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership.

UNIT - V

Software configuration management, Software Quality assurance, Risk Analysis, Instream activities-Project Initiation, Project planning and tracking, Project closure.

Text Books:

1. Software Project Management, Walker Royce, Pearson Education ,2014
2. Managing Global Software Projects , Gopalaswamy Ramesh, Tata McGraw-Hill ,2002

Suggested Reading:

1. An Introduction to the Team Software Process, Watts S. Humphrey, Pearson Education, 2000
2. Process Improvement essentials, James R. Persse, O'Reilly, 2006
3. Software Project Management, Bob Hughes & Mike Cotterell, fourth edition, TMH, 2006
4. Applied Software Project Management, Andrew Stellman & Jennifer Greene, O'Reilly, 2006.
5. Head First PMP, Jennifer Greene & Andrew Stellman, O'Reilly, 2007
6. Software Engineering Project Management, Richard H. Thayer & Edward Yourdon, 2nd edition, Wiley India, 2004.
7. Agile Project Management, Jim Highsmith, Pearson education, 2004.

Online Resources:

1. Software Project Management - Course (nptel.ac.in)
2. Software Engineering: Software Design and Project Management Course by The Hong Kong University of Science and Technology | Coursera

22CSE25

CLOUD COMPUTING ESSENTIALS
(Professional Elective - III)

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

Prerequisite: Data communication and computer networks.

Course Objectives: This course aims to

1. Understand the significance of cloud computing services.
2. Understand the cloud infrastructure and Technologies.
3. Learn the security implementation features in cloud computing.

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

1. Understand the need of cloud technology and terminology.
2. Identify and understand the cloud infrastructure.
3. To understand and apply various virtualization concepts.
4. Design solutions for the automation and migration of manual data centers.
5. Analyze the Cloud Security and privacy issues.

CO-PO& PSO Articulation Matrix

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

UNIT - I

Era of Cloud Computing – Motivation, Elastic Computing and advantages- Multi-Tenant clouds, Elastic computing, Virtualized servers uses, Business model for Cloud Providers. Types of Clouds and Cloud Providers, Multi-Cloud, Hyperscalers, advantages of clouds;

UNIT - II

Virtualization and Containers -Virtual machines, hypervisor, approaches to virtualization, advantages and disadvantages of VMs, Virtual I/O devices, VM migration; Traditional apps and elasticity on demand, isolation facilities in an OS, Docker containers, Docker Terminology and Development tools.

UNIT - III

Virtual Networks – Goals of a data center network, Network hierarchies, capacity, Fat Tree Designs. Link aggregation, VLANS, VXLAN, NAT, Managing virtualization and mobility, SDNs, openflow protocol, Programming networks; Virtual Storage: NAS, SAS, mapping virtual disks to physical disks.

UNIT - IV

Automation and Cloud Programming - Need of automation, levels, AIops, automation tools, automation of manual data center practices, evolution of automation; Orchestration: legacy of automating procedures, larger scope of automation, Kubernetes MapReduce, Microservices, Serverless computing, event processing, DevOps, Edge Computing and IIoT.

UNIT - V

Cloud security and Privacy – cloud specific problems, zero trust security model, identity management, privileged access management(PAM), AI technologies and their effects on their security, Protection of remote access and privacy in a cloud environment, back doors, side channels and other concerns, firewalls

Text Books:

1. Douglas Comer, "The Cloud Computing Book: The Future of Computing Explained", A Chapman and Hall/CRC, 1st Edition Kindle Edition, 2021.
2. Anthony T Velte, Toby J, Robert Elenpeter, "Cloud Computing – A Practical Approach", McGra Hill, 2010.

Suggested Reading:

1. https://www.amazon.in/Cloud-Computing-Book-Future-
2. Explained/dp/0367706806?asin=B097N7NKJD&revisionId=&format=4&depth=1

22ITE024

COMPUTER VISION
(Professional Elective-III)

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

Course Objectives:

1. To Understand the fundamental concepts related to computer vision and Image formation.
2. To Learn feature detection, matching and detection.
3. To Become familiar with feature based alignment.
4. To Develop skills on 3D reconstruction.
5. To Understand Object Detection Techniques.

Course Outcomes:

Upon completing this Course, Students will be able to:

1. Understand Fundamentals of computer vision and physics of color.
2. Employ Image processing techniques.
3. Illustrate 2D Feature Based Image Alignment, Feature Detection and Segmentation.
4. Apply 3D Image Reconstruction Techniques.
5. Develop Innovative Computer Vision Applications.

CO-PO& PSO Articulation Matrix

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

UNIT-I

Introduction to Computer Vision: Computer vision , Applications of computer vision, Computer vision pipeline , Image input, Image preprocessing , Feature extraction , Classifier learning algorithm. Color: The Physics of Colour, Human Colour Perception , Representing Colour. Application: Finding Specularities, Surface Colour from Image Colour.

UNIT-II

Image Formation and Processing:

Geometric primitives and transformations, Photometric image formation, digital camera, Point operators, Linear filtering, neighborhood operators, Fourier transforms, Pyramids and wavelets, Geometric transformations, Global optimization.

UNIT-III

Feature Detection, Matching and Segmentation: Points and patches, Edges - Lines, Segmentation, Active contours , Split and merge, Mean shift and mode finding, Normalized cuts, Graph cuts and energy-based methods. Feature-based Alignment: 2D and 3D Feature Based Alignment, Pose estimation, Geometric intrinsic calibration.

UNIT-IV

3D Reconstruction: Shape from X, Active range finding, Surface representations, Point-based representations, volumetric representations, Model-based reconstruction, Recovering texture maps and albedosos.

UNIT- V

Object detection: General object detection framework, Region-based convolutional neural networks (R-CNNs), Single-shot detector (SSD) , You only look once (YOLO). Generative adversarial networks (GANs): GAN architecture , Evaluating GAN models , Popular GAN applications.

Text Books:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer- Second Edition, 2022.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015
3. Deep Learning for Vision Systems, Mohamed Elgendy, Manning Publications,2020.

Suggested Reading:

1. R. Hartley and A. Zisserman, "Multiple View geometry", Cambridge university Press, 2002.
2. Richard Hartley and Andrew Zisserman, "Multiple View Geometry in Computer Vision", Second Edition, Cambridge University Press, March 2004.
3. 3. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.

Web Resources:

1. CV online: http://homepages.inf.ed.ac.uk/rbf/CVonline
2. https://nptel.ac.in/courses/108103174
3. https://opencv.org/opencv-free-course/
4. https://docs.opencv.org/4.x/d9/df8/tutorial_root.html

22CAE08N

REINFORCEMENT LEARNING
(Professional Elective-IV)

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

Prerequisites: Probability and Statistics, Machine Learning, Data Structures

Course Objectives:
1. To Understand the fundamental principles of Reinforcement Learning and MDP Process
2. To Analyze Monte Carlo Methods and Temporal-Difference learning techniques.
3. Evaluate the use of Eligibility Traces in reinforcement learning through case studies

Course Outcomes: After completion of the course, students will be able to
1. Acquire the fundamental concepts of Reinforcement Learning.
2. Apply the concepts of Finite Markov Decision Process to solve the complex problems.
3. Analyze and evaluate the effectiveness of Monte Carlo methods and On/Off Policy methods
4. Analyze and apply Temporal Difference Learning for real world problems.
5. Evaluate eligibility traces and novel reinforcement learning solutions.

CO-PO& PSO Articulation Matrix

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

UNIT-I:
Introduction to Reinforcement Learning:-Examples, History of RL, Limitations, Scope, Elements of Reinforcement Learning, An n-armed bandit problem, Action-value methods, Incremental Implementation, Tracking a nonstationary problem, Optimistic initial values, Upper- Confidence-Bound Action Selection, Gradient bandits.

UNIT-II:
Finite Markov Decision Processes: The Agent-Environment Interface, Goals and Rewards, Returns, Unified Notation for Episodic and Continuing Tasks, The Markov Property, Markov Decision Processes, Value Functions, Optimal Value Functions, Optimality and Approximation.

UNIT-III:
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, Off-policy monte carlo control

UNIT-IV:
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-V:
Eligibility Traces: n-step TD prediction, The forward view of TD(λ),the backward view of TD(λ), Equivalences of forward and backward views, Sarsa(λ), Watkin's Q(λ), Off-policy eligibility traces using importance sampling.

Case studies: TD-Gammon, Samuel's Checkers Player.

Text Books:

1. "Reinforcement learning: An introduction," First Edition, Sutton, Richard S., and Andrew G. Barto, MIT press 2020.
2. "Statistical reinforcement learning: modern machine learning approaches," First Edition, Sugiyama, Masashi. CRC Press 2015.

Reference Books:

1. "Bandit algorithms," First Edition, Lattimore, T. and C. Szepesvári. Cambridge University Press. 2020.
2. "Reinforcement Learning Algorithms: Analysis and Applications," Boris Belousov, Hany Abdulsamad, Pascal Klink, Simone Parisi, and Jan Peters First Edition, Springer 2021.
3. Alexander Zai and Brandon Brown "Deep Reinforcement Learning in Action," First Edition, Manning Publications 2020.

Online Resources:

1. https://nptel.ac.in/courses/106106143
2. https://www.coursera.org/specializations/reinforcement-learning

22CIE56

CYBER SECURITY: ATTACKS & DEFENSES
(Professional Elective-IV)

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

Pre-Requisites

Programming and problem solving, Operating systems, Computer networks, Fundamentals of Cyber Security and Tools, Cryptography and Network Security.

Course Objectives

By the end of this course, students should be able to:

1. Understand the foundational concepts of cybersecurity, including common threats like viruses, trojans, and vulnerabilities.
2. Analyse attacker techniques, motivations, and ant forensics strategies used to bypass detection systems.
3. Apply knowledge of exploitation methods such as buffer overflows, SQL injections, and shellcode to simulate common attack vectors.
4. Evaluate cyber intelligence, warfare strategies, and the implications of international cybersecurity laws like the Tallinn Manual.
5. Create strategic defenses against current and emerging threats by integrating knowledge of threat landscapes, next-gen attack techniques, and cybersecurity transformations (IoT, Cloud, Big Data).

Course Outcomes

1. Demonstrate an in-depth understanding of the dark side of computing and key security principles of modern operating systems like Microsoft Windows.
2. Identify and assess various hacking techniques and tunneling methods used by cybercriminals to cover their tracks.
3. Develop countermeasures by simulating and mitigating exploitation techniques, including format string vulnerabilities, race conditions, and malicious file attacks.
4. Critically evaluate the nature of cyber conflicts and warfare, and propose ethical and legal solutions based on global cybersecurity frameworks.
5. Apply futuristic cybersecurity strategies by incorporating virtualization, IoT, cloud computing, and social engineering trends into secure systems.

CO-PO& PSO Articulation Matrix

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

Unit – I

Introduction: The Dark Side of the Computer, Viruses, Trojans, and Attacks, Vulnerabilities, Risk Assessment, Risk Management, Emerging Field of Cybersecurity, Microsoft Windows Security Principles.

Unit – II

Attackers' Techniques and Motivations: How Hackers Cover Their Tracks (Antiforensics), Tunneling Techniques, Fraud Techniques, Threat Infrastructure.

Unit – III

Exploitations: Techniques to Gain a Foothold: Shellcode, Integer Overflow Vulnerabilities, Stack-Based Buffer Overflows, Format String Vulnerabilities, SQL Injection, Malicious PDF Files, Race Conditions, Web Exploit Tools, Misdirection, Reconnaissance, and Disruption Methods.

Unit – IV

Cyber Intelligence, Cyber Conflicts, and Cyber Warfare: Introduction, Information Warfare Theory and Application, Cyber Intelligence and Counter-Intelligence, DoD-The U.S. Cyber Command, Nation-State Cyber Conflicts, Cyber Warfare and the Tallinn Manual on International Law.

Unit – V

Cybersecurity Threat Landscape and Future Trends: Introduction, Breaches—Global Data, Threat Landscape: Traditional Threats, Social Engineering Threats, Buffer Overflow and Structured Query Language Injection, Next-Generation Threats, Attacker's Need for Information, Transformational Changes for Cybersecurity: Virtualization, social media, Internet of Things, Cloud Computing, Big Data, Preparing Future Generations for Cybersecurity Transformational Challenges.

Textbook:

1. Johnson, T. A. (2015). Cybersecurity: Protecting Critical Infrastructures from Cyber Attack and Cyber Warfare. CRC Press, Taylor & Francis Group.
2. Graham, J., Howard, R., & Otson, R. (2010). Cyber Security Essentials. CRC Press.

Reference Books

1. Holt, T. J., Bossler, A. M., & Seigfried-Spellar, K. C. (2020). Cybercrime and digital forensics: An introduction (2nd ed.). Routledge.
2. Godbole, N., & Belapure, S. (2011). Understanding cyber-crimes, computer forensics, and legal perspectives. Wiley India.

Web Reference

1.https://nptel.ac.in/courses/106106248

22ITE11

DEVOPS TOOLS
(Professional Elective-IV)

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

Course Objectives:

This course is designed to:

1. Provide a comprehensive understanding of DevOps principles and their role in modern software development.
2. Explain the importance of version control systems, with a focus on Git.
3. Explore continuous integration and continuous deployment (CI/CD) using tools like Jenkins and Maven.
4. Introduce containerization concepts through Docker.
5. Explain the automation of software deployment processes using configuration management tools.

Course Outcomes:

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

1. Explain the core concepts and benefits of DevOps in software engineering.
2. Analyze the role of version control systems in collaborative development.
3. Describe the CI/CD pipeline and evaluate tools like Jenkins and Maven.
4. Illustrate the use of Docker in containerizing applications.
5. Discuss automated deployment strategies using tools such as Puppet.

CO-PO& PSO Articulation Matrix

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

UNIT-1

Introduction to DevOps , DevOps Perspective , DevOps and Agile , Team Structure , Coordination , Barriers , The Cloud as a Platform: Features of the Cloud , DevOps Consequences of the Unique Cloud Features , Operations: Operations Services, Scrum, Kanban, and Agile.

UNIT-2

Overview GIT and its principal command lines: Installation, Configuration, Vocabulary, Git Command Lines, Understanding the GIT process and Gitflow pattern: Starting with the Git Process, Isolating your code with branches, Branching Strategy with Gitflow.

UNIT-3

Continuous Integration and Continuous Delivery: Technical Requirements CI/CD principles, Using a package manager in the CI/CD process, Using Jenkins for CI/CD implementation , Using GitLab CI .

UNIT-4

Containerizing your application with Docker: Installing Docker, Creating Docker file, Building and running a container on a local machine, Pushing an Image to Docker Hub, Deploying a container to ACI with CI/CD pipeline. Using Docker for running command Line tools, Introduction to Kubernetes Tools: Docker Compose, Docker Swarm

UNIT-5

Getting Started with Docker Composer, Deploying a Docker compose containers in ACI, Installing Kubernetes, First example of Kubernetes application of deployment, Deploying the code: The Puppet master and Puppet agents, Ansible, PalletOps, Deploying with SaltStack, DevOps Best Practices, Tools: Ansible, Saltstack

TEXT BOOKS:

1. Len Bass, Ingo Weber and Liming Zhu, DevOps: A Software Architect's Perspective, Addison-Wesley, Pearson Publication, Second Edition, 2015.
2. Mikael Krief, Learning DevOps: A comprehensive guide to accelerating DevOps culture adoption with Terraform, Azure DevOps, Kubernetes, and Jenkins, Packt Publishing , 2022.

REFERENCE BOOKS:

1. Mastering Puppet 5: Optimize enterprise-grade environment performance with Puppet, Ryan Russell and Jason Southgate, Packt Publishing ,2018.
2. Joakim Verona, Practical DevOps, Packt Publishing , 2018.

22ITE13

UNMANNED AERIAL VEHICLES
(Professional Elective-IV)

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

Course Objectives:

This course aim to :

1. Familiarize basics of Autonomous vehicles and its various applications.
2. Learn the Basics of navigation and explain the components used to build the drone devices.
3. Acquaint with the concepts of UAV aircraft and basics of Robot Programming.
4. Provide the payload and Navigation of Autonomous Vehicles.
5. Introduce the benefits of combining AI and Drones.

Course Outcomes:

Upon completing this course, students will be able to:

1. Understand the types, characteristics, Applications of Autonomous systems.
2. Analyze the concepts of Aerodynamics, Propulsion & Structures of Model aircraft.
3. Know the UAV / UGV Elements and Robot Arm Kinematics & Dynamics.
4. Infer about Navigation and guidance of Autonomous vehicles.
5. Explore applications of Drones in Artificial Intelligence .

CO-PO& PSO Articulation Matrix

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO 1	2	2	1	1	2	1	0	1	1	1	1	1	3	2
CO 2	2	2	1	2	0	1	0	0	1	1	1	1	3	2
CO 3	2	2	1	1	0	1	0	1	1	1	1	1	3	2
CO 4	2	2	1	1	1	2	0	1	1	1	1	1	3	2
CO 5	2	2	1	1	1	1	0	0	1	1	1	1	3	2

UNIT-I

Introduction to Autonomous systems: Definition, Characteristics, differences between non autonomous Vs autonomous, Types of vehicles, Introduction to navigation and communication.

UNIT-II

Basics of navigation (Aerial and Ground): Different types of flight vehicles; Components and functions of an airplane; Forces acting on Airplane; Physical properties and structure of the atmosphere; Aerodynamics – aerofoil nomenclature, aerofoil characteristics, Angle of attack, Mach number, Lift and Drag, Propulsion and airplane structures.

UNIT-III

UAV / UGV Elements: Introduction to UAV and UGV, DGCA Classification of UAVs; Types and Characteristics of Drones: Fixed, Multi-rotor, Flight controller Software, MAVLINK protocol, Robot Arm Kinematics and Dynamics, Manipulator Trajectory planning and Motion Control, Robot Sensing, Robotic Operating System, Robotic Programming Languages.

UNIT-IV

Navigation and Guidance: Data Link; Sensors and Payloads: GPS, IMU, Light Detection and Ranging (LiDAR), Imaging cameras, Classification of payload based on applications; Hyper-spectral sensors; Laser Detection and Range (LiDAR); cameras; ultra-sonic detectors; Introduction to navigation systems and types of guidance; Mission Planning and Control, Case studies: Autonomous Obstacle avoidance - Vision, Sonar and LiDAR.

UNIT-V

AI Drones: Benefits of Combining AI and Drones, Applications of AI-Powered Drones, Challenges and ethical considerations, Drone Swarm Technologies and Algorithms, Case Studies Drone Swarms, IoT Drones.

Text books :

1. K Valavanis; George J Vachtsevanos,"Handbook of Unmanned Aerial Vehicles", Springer, Boston, Massachusetts : Credo Reference, 2014. 2016.
2. K.S. Fu, R.C. Gonzalez, C.S.G. Lee, Robotics : Control, Sensing, Vision and Intelligence
3. John J. Craig, Introduction to Robotics: Mechanics and Control, Addison Wesley publication, 3rd Edition.
4. **Reg Austin"Unmanned Aircraft Systems: UAVS Design, Development and Deployment" John Wiley & Sons, Ltd.2011.**
5. Fahlstrom P, Gleason T (2012) "Introduction to UAV systems", 4th edn. Wiley, UK
6. Yang, L. J., & Esakki, B. (2021). Flapping Wing Vehicles: Numerical and Experimental Approach. CRC Press.
7. Sebbane, Y. B. (2022). A first course in aerial robots and drones. CRC Press.

Suggested Reading:

1. Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs, John Baichtal DGCA RPAS Guidance Manual, Revision 3 – 2020
2. Aaron Martinez, Enrique Fernandez, Learning ROS for Robotics Programming: A practical, instructive, and comprehensive guide to introduce yourself to ROS, the top-notch, leading robotics framework, PACKT publishing, Open Source.
3. Andy Lennon, "Basics of R/C Model Aircraft Design" Model Airplane News Publication
4. John Baichtal, Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs.
5. DGCA RPAS Guidance Manual, Revision 3 - 2020

Web Resources :

1. https://onlinecourses.swayam2.ac.in/ntr24_ed12/preview
2. https://archive.nptel.ac.in/courses/101/104/101104073/
3. https://onlinecourses.nptel.ac.in/noc21_ae14/preview

22ADE14

GENERATIVE AI
(Professional Elective-IV)

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

Pre-requisites: Python Programming, Deep Learning

Course Objectives: This course aims to:

1. Introduce the fundamentals of generative modeling and deep learning.
2. Explore key architectures including VAEs, GANs, and Diffusion Models.
3. Apply TensorFlow/Keras to build generative models
4. Understand applications of generative AI in text, image, music, and multimodal domains.
5. Examine current and future trends in generative AI and its real-world impact.

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

1. Understand foundational concepts of generative modelling, probability theory, and Variational Autoencoders.
2. Analyze and implement various GAN architectures for generating synthetic data and images.
3. Explore and evaluate diffusion models including training, sampling, and analysis processes.
4. Apply transformer-based architectures for language modelling and fine-tune encoder/decoder models.
5. Develop effective prompting strategies to control and enhance outputs from generative language models.

CO-PO& PSO Articulation Matrix

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

UNIT - I

Generative Modelling: What is Generative Modelling, Generative vs. Discriminative Models, The Rise of Generative Modelling, Generative Modelling Framework, **Core Probability Theory**: Sample Space, Probability Density Function, Parametric Modeling, Likelihood, Maximum Likelihood Estimation, **Variational Autoencoder**: Architecture, Exploring the Latent Space,

UNIT- II

Generative Adversarial network : Introduction, Deep Convolution GAN, Wasserstein GAN with Gradient Penalty (WGAN-GP), Conditional GAN (CGAN), **Advanced GAN**: Progressive GAN, StyleGAN, StyleGAN2

UNIT- III

Diffusion Models: Introduction, Denoising Diffusion Models (DDM) and its process, Diffusion Schedules, The Reverse Diffusion Process,The U-Net Denoising Model- Training, Sampling and Analysis, Stable Diffusion, DALL.E 2- Architecture, training Process, GLIDE, ImageGen

UNIT - IV

Transformers: Introduction, Architecture- Attention, Multi head Attention, Masking, Transformer Block, Encoder Based only Transformers Architectures and Fine Tuning : BERT, **Generative LLMs**: Introduction to

LLMs, Decoder-only Transformers, Training LLMs, Fine-tuning LLMs, Introduction to various LLM: GPT, Falcon, LLaMA2

UNIT- V

Prompt Engineering: Introduction, Prompt Engineering Strategies, **Advanced Prompting Methods**: Chain of Thought, Problem Decomposition, Self-refinement, Ensembling, RAG and Tool Use, **Learning to Prompt:** Prompt Optimization,Soft Prompts

TEXT BOOK:

1. David Foster, Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play, Second Edition, O'Reilly Media, 2023.
2. Tong Xiao, Jingbo Zhu. *Foundations of Large Language Models*. arXiv:2501.09223 [cs.CL], January 16, 2025.

SUGGESTED BOOKS:

1. Joseph Babcock Raghav Bali, Generative AI with Python and Tensor flow 2, Packt Publishing Ltd. UK, 2021

WEB RESOURCES:

1. https://paperswithcode.com
2. https://huggingface.co/
3. https://arxiv.org/pdf/2501.09223

22EEO01

ENERGY MANAGEMENT SYSTEM

(Open Elective-II)

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

Prerequisites: None.

COURSE OBJECTIVES: This course aims to

1. Know the concept of Energy Management.
2. Understand the formulation of efficiency for various Engineering Systems
3. Enable the students to develop managerial skills to assess feasibility of alternative approaches and drive strategies regarding Energy Management

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

1. Know the current Energy Scenario and importance of Energy Conservation.
2. Understand the concepts of Energy Management, Energy Auditing.
3. Interpret the Energy Management methodology, Energy security and Energy Strategy.
4. Identify the importance of Energy Efficiency for Engineers and explore the methods of improving Energy Efficiency in mechanical systems, Electrical Engineering systems
5. Illustrate the Energy Efficient Technologies in Civil and Chemical engineering systems

CO-PO & PSO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	1	-	-	1	-	2	1	-	-	-	1			
CO 2	2	1	1	1	-	2	1	-	-	-	1			
CO 3	2	2	2	1	-	2	1	-	-	-	1			
CO 4	2	2	1	2	2	2	1	-	-	-	1			
CO 5	1	1	2	1	1	2	2	-	-	-	1			

UNIT-I

Various forms of Energy and its features: Electricity generation methods using different energy sources such as Solar energy, wind energy, Bio-mass energy, and Chemical energy such as fuel cells. Energy Scenario in India, Impact of Energy on economy, development, and environment sectors of national and international perspective.

UNIT-II

Energy Management-I: Defining Energy Management, need for Energy Management, Energy management techniques, importance of Energy Management, managing the Energy consumption, Energy Audit and Types, Energy Audit Instruments.

UNIT-III

Energy Management-II: understanding Energy costs, bench marking, Energy performance, matching energy use to requirement, optimizing the input, fuel & Energy substitution, material and Energy balance diagrams, Energy pricing, Energy and Environment, Energy Security

UNIT-IV

Energy Efficient Technologies-I: Importance of Energy Efficiency for Engineers, Energy Efficient Technology in Mechanical engineering: Compressed Air System, Heating, ventilation and air- conditioning, Fans and blowers, Pumps and Pumping Systems,

Energy Efficient Technology in Electrical engineering: Automatic Power Factor Controllers, Energy Efficient Motors, soft starters with energy saver, variable speed drives, energy efficient transformers, electronic ballast,

occupancy sensors, energy efficient lighting controls, space cooling, energy efficiency of lifts and escalator, energy saving potential of each technology.

UNIT-V

Energy Efficient Technologies-II: Energy Efficient Technology in Civil Engineering: Intelligent Buildings, And Various Energy Efficiency Rating Systems for Buildings, Green Buildings Energy Efficiency: management of green buildings, importance of embodied energy in selection of sustainable materials, green building design, waste reduction/recycling, rainwater harvesting, maintenance of the green buildings, green building certification, Renewable energy applications.

Energy Efficient Technology in Chemical Engineering: Green chemistry, Low carbon cements, recycling paper.

TEXT BOOKS:

1. Umesh Rathore, 'Energy Management', Kataria publications, 2nd ediiton, 2014.
2. G Hariharaiyer, “Green Building Fundamentals”, Notion press.com
3. K V Shama, P Venkataseshaiah, "Energy management and conservation", I. K. International Publishing agency pvt. ltd., 2011, ISBN: 978-93-81141-29-8

SUGGESTED READING:

1. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, General Aspects
2. 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 Universityof Technology.
3. Success stories of Energy Conservation by BEE, New Delhi (www.bee-india.org)

22EGO02

GENDER SENSITIZATION

(Open Elective – II)

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

Prerequisite: No specific prerequisite is required.

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 in which gender intersects with race, class, sexuality, ethnicity, ability, religion, and nationality.
5. Demonstrate an understanding of personal life, the workplace, the community and active civic engagement through classroom learning.

CO-PO& PSO Articulation Matrix

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

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 and Labour:

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, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu"Towards a World of Equals: A Bilingual Textbook on Gender", Telugu Akademi, Hyderabad, 2015.

Suggested Reading:

1. Menon, Nivedita. "Seeing like a Feminist", Zubaan-Penguin Books, New Delhi, 2012.
2. Abdulali Sohaila, "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

Note: Since it is an Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

22MEO03

CORPORATE ORGANIZATIONAL BEHAVIOUR
(Open Elective -II)

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

Prerequisite: Nil.

Course Objectives: This course aims to
1. Define basic organizational behaviour principles and analyze how these influence behaviour in the work place.
2. Analyze the influence of perceptions and personality on individual human behaviour in the work place.
3. Discuss the theories of Motivation and Leadership.
4. Provide knowledge on different organizational structures; and concepts of culture, climate and organizational development and make the students familiarize with individual behavior.
5. Describe the interpersonal and their intrapersonal reactions within the context of the group and also demonstrate effective communication and decision making skills in small group settings

Course Outcomes: Upon completion of this course, students will be able to
1. Understand Organizational Behavioural principles and practices.
2. Compare various organizational designs and cultures enabling organizational development.
3. Apply motivational theories and leadership styles in resolving employee‘s problems and decision making processes.
4. Understand the group dynamics, communication network, skills needed to resolve organizational conflicts.
5. Analyze the behaviour, perception and personality of individuals and groups in organizations in terms of the key factors that influence organizational behavior.

CO-PO& PSO Articulation Matrix

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

UNIT –I

Introduction: Organizational behaviour, nature and levels of organizational behavior, individuals in organization, individual differences , personality and ability, the big 5 model of personality , organizationally relevant personality traits, the nature of perception , characteristics of the perceiver, target and situation , perceptual problems.

UNIT – II

Organization structure: Organizational designs and structures, traditional and contemporary organizational designs, organizational culture and ethical behaviour, factors shaping organizational culture, creating an ethical culture, concepts, organizational climate, organization conflict, and organization development.

UNIT – III

Motivation and leadership: Motivation, early and contemporary theories of motivation, leadership, early and contemporary approaches to leadership.

UNIT – IV

Group dynamics: Groups and group development, turning groups into effective teams, managing change , process, types and challenges, communicating effectively in organizations, communication process, barriers to communication, overcoming barriers to communication, persuasive communication, communication in crisis situations.

UNIT – V

Power, Politics, Conflict and Negotiations: Power, politics, conflict and negotiations, sources of individual, functional and divisional power, organizational politics conflict, causes and consequences, Pondy's model of organizational conflict, conflict resolution strategies.

Text Books:

1. Jennifer George and Gareth Jones, Understanding and Managing Organizational Behaviour, Pearson Education Inc., 2012.
2. Jon L Pierce and Donald G. Gardner, Management and Organizational behaviour, Cengage Learning India (P) Limited, 2001.
3. Richard Pettinger, Organizational Behaviour, Routledge, 2010

Suggested Reading:

1. Stephen P. Robbins, Jennifer George and Gareth Jones, Management and Organizational Behaviour, Pearson Education Inc., 2009.
2. John Schermerhorn, Jr., James G. Hunt and Richard N. Osborn, Organizational Behaviour, 10th edition, Wiley India Edition, 2009.

22CHO04

ENVIRONMENTAL AND SUSTAINABLE DEVELOPMENT
(Open Elective-II)

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

Course Objectives: This course will help the students:

1. To have an increased awareness on issues in areas of sustainability
2. To understand the role of engineering & technology within sustainable development
3. To know the methods, tools and incentives for sustainable product service system development
4. To establish a clear understanding of the role and impact of various aspects of engineering decisions on environmental, societal and economic problems.
5. To communicate results related to their research on sustainable engineering

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

1. Understand the concept of sustainable engineering and its significance in addressing contemporary environmental challenges.
2. Explore the 4R concept of solid waste management and examine various tools and methodologies to assess and mitigate the environmental impacts of engineering activities.
3. To be aware of the principles and requirements of environmental management standards and their application in promoting environmental sustainability.
4. Analyze the challenges and opportunities associated with promoting sustainable habitats such as sustainable cities, sustainable transport, sustainable sources of energy conventional and sustainable materials for green buildings
5. Understand and evaluate the industrial processes through the principles of industrial ecology and industrial symbiosis.

CO-PO& PSO Articulation Matrix

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

UNIT I

Introduction of sustainability- Need and concept of Sustainable Engineering, Social-environmental and economic sustainability concepts, Sustainable development and challenges, Sustainable Development Goals, Environmental acts and protocols – Clean Development Mechanism (CDM).

UNIT II

Economic and social factors affecting sustainability, Effects of pollution from natural sources, Solid waste-sources, impacts, 4R (Reduce, Reuse, Recycling, Recover) concept, Ozone layer depletion, Global warming, Tools used to ensure sustainability in engineering activities such as environmental management systems and environmental impact assessment studies.

UNIT III

Global, Regional and Local environmental issues, Carbon credits and Carbon trading, Carbon foot print, Environmental management standards, ISO 14000 series, Life cycle Analysis (LCA)-scope and goal, Procedures of EIA (Environment Impact Assessment) in India.

UNIT IV

Basic concept of sustainable habitat-Sustainable cities, Sustainable transport, Sustainable sources of energy conventional and renewable sources, Green Engineering: Green buildings, Green materials for sustainable design, Methods for increasing energy efficiencies of buildings**.**

UNIT V

Technology and sustainable development, Sustainable urbanization, Industrialization and poverty reduction, Social and Technological change, Industrial processes-material selection, Pollution prevention, Industrial ecology, Industrial symbiosis.

Text book:

1. Rag R. L., Introduction to Sustainable Engineering, 2nd Ed, PHI Learning Pvt Ltd, 2016.
2. Allen D. T and Shonnard D. R., Sustainability Engineering Concepts, Design and Case Studies, 1 st Ed, Prentice Hall, 2011.

Suggested Reading

1. Bradley A. S, Adebayo A. O and Maria. P., Engineering Applications in Sustainable Design and Development, 1st Ed, Cengage Learning, 2016.
2. Krishna R. Reddy, Claudio Cameselle, Jeffrey A. Adams., Sustainable Engineering,1st Ed, Wiley, 2019.

Online resources:

1. Sustainable Engineering concepts and Life cycle analysis
   https://archive.nptel.ac.in/courses/105/105/105105157/
2. Sustainable Energy Technology
   https://onlinecourses.nptel.ac.in/noc23_me138/preview

22MEO06

PRINCIPLES OF ENTREPRENEURSHIP AND STARTUPS
(Open Elective-II)

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

Prerequisite: Nil

Course Objectives: This course aims to
1. Impart basic concepts and procedure of idea generation.
2. Familiarize the nature of industry and related opportunities and challenges.
3. Familiarize with elements of business plan and its procedure.
4. Learn the project management and its techniques.
5. Know the behavioral issues and time management.

Course Outcomes: Upon completion of this course, the 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.

CO-PO& PSO Articulation Matrix

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

UNIT - I

Entrepreneurship: Definition, Characteristics of an Entrepreneur, Functions of Entrepreneurs, Entrepreneur vs. Intrapreneur, First Generation Entrepreneur, Women Entrepreneurship, Ideas and their Sources, Conception and Evaluation of Ideas.

Behavioral Aspects of Entrepreneurs: Personality: Determinants, Attributes and Models, Leadership: Concepts and Models, Values and Attitudes, Motivation Aspects.

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.

UNIT - IV

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

Time Management: Approaches of Time Management, their strengths and weaknesses. Time Management Matrix, Urgency Addiction.

UNIT - V

Startup: Definition, Startup Ecosystem, Startup Incubator, Need and Importance of Startups and Incubation Centers. Sources of Finance and Incentives for Startups. Innovation, Creativity, Intellectual Property in Entrepreneurial Journey. Business firm Registration Process in INDIA.

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.

22EGM01

INDIAN CONSTITUTION AND FUNDAMENTAL PRINCIPLES

(BE/BTech III/IV/VI/VII Semester - Common to all branches)

Instruction	2 L Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	0
Credits	Non Credit

Prerequisite: Basic awareness of Indian Constitution and Government.

Course Objectives:

The course will introduce the students to:

1. Understand the history of framing of the Indian Constitution.
2. Awareness on Fundamental Rights, Duties and Directive Principles of State Policy.
3. Explore the organization of Union Government, and functions of President and Prime Minister.
4. Gain an insight into the inter-functionality of Union Legislature and Judiciary
5. Educate on the local governance and problems in development of rural and urban areas.

Course Outcomes:

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

1. Understand the history of framing of the Indian Constitution and its features.
2. Assess the realization of Fundamental Rights and Directive Principles of State Policy.
3. Analyze the challenges to federal system and position of the President and the Prime Minister in the Union Government.
4. Underline the role of the Legislature and the Judiciary in Union Government and their mutual relations.
5. Evolve the development of the local governments in India and assess the role of Collector in district administration.

CO-PO & PSO Articulation Matrix

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

Unit-I

Constitutional History and Framing of Indian Constitution

East India Company rule (1757-1857): Social, Economic, Political and Administrative impact of Company rule in India. British Rule (1858-1947): Indian National Movement, Government of India Acts 1909, 1919 and 1935, and Indian Independence Act 1947. Framing of the Indian Constitution: Constituent Assembly, Preamble and Salient Features.

Unit-II

Fundamental Rights, Duties and Directive Principles of State Policy

The Fundamental Rights: Features and significance of Rights. Fundamental Duties: Importance and the legal status of Duties. Directive Principles of State Policy: Socialist, Gandhian and Liberal-intellectual principles, importance and relevance.

Unit-III

Union Government and its Administration

Federalism: Division of legislative and financial powers between the Union and the State. Union Executive: Role and position of President, Prime Minister and Council of Ministers. Emergency Provisions: National Emergency, Constitutional Emergency and Financial Emergency.

Unit-IV

Union Legislature and Judiciary

Union Legislature: Parliament of India-Composition and functions of Parliament, and Parliamentary Committees. Union Judiciary: Supreme Court of India-Composition and Functions.

Unit-V

Local Self Governments

Rural Local Governments: Zilla Parishad- CEO and functions of Zilla Parishad, Mandal Parishad- Role of Elected and Officials, Gram Panchayat- Sarpanch, Secretary and Gram Sabha. Urban Local Governments: Structure and functions of Municipalities and Municipal Corporations. District Collector: Powers and functions of Collector.

Text Books:

1. Sastry Ravindra, (Ed), "Indian Government & Politics", Telugu Akademy, 2nd edition, 2018.
2. "Indian Constitution at Work", NCERT, First edition 2006, Reprinted in 2022.

Suggested Reading:

1. D.D. Basu, "Introduction to the Constitution of India", Lexis Nexis, 2015.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, "Framing of Indian Constitution", 1st Edition, 2015.
3. Granville Austin, "The Indian Constitution: The Cornerstone of a Nation", OUP, 2nd Edition, 1999.
4. M.V. Pylee, "India's Constitution", S. Chand Publishing, 16th Edition, 2017.
5. Rajeev Bhargava (ed), "Politics and Ethics of the Indian Constitution", OUP, 2008.

22CAE09N

REINFORCEMENT LEARNING LAB
(Professional Elective- IV Lab)

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

Pre-requisites :- Probability & Statistics, Data Structures and Algorithms, Machine Learning

Course Objectives:-

1. Understand and implement fundamental concepts of Reinforcement Learning algorithms
2. Apply the concepts of Finite MDP and Monte Carlo Methods
3. Analyze TD learning and evaluate Eligibility traces using case studies.

Course Outcomes:-

Upon successful completion of the lab, the students will be able to :-

1. Understand and implement basic concepts of reinforcement learning
2. Design and implement MDP using value and policy iterations
3. Analyze and implement Monte Carlo Methods and TD learning algorithms
4. Apply and evaluate eligibility traces using case studies
5. Develop and implement RL algorithms to solve complex real world problems

CO-PO & PSO Articulation Matrix

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

List of Experiments: -

1. Write a program to implement n-armed bandit problem, where different actions have unknown reward probabilities.
2. Write a program to implement value iteration and policy iteration algorithms for solving MDPs by using a simple grid world environment.
3. Write a program to implement the Monte Carlo Prediction Algorithms to estimate the value function for a given policy by applying on any simple environment.
4. Write a program to implement the Q-Learning Algorithm to find an optimal policy for navigating the grid with different learning rates and exploration strategies.
5. Write a program to implement the SARSA Algorithm for on-policy control in a grid or maze environment and compare its performance with Q-learning.
6. Write a program to implement the reinforcement-learning agent to play backgammon, similar to famous TD-Gammon Program.
7. Write a program that uses reinforcement learning to solve job-shop scheduling problems.
8. Write a program that visualizes the eligibility Traces for different values of λ . Observe how the eligibility traces affect the learning in TD (λ) algorithms.
9. Design and develop reinforcement learning program that implement Samuel's Checkers Player.
10. Implement TD (0), SARSA and Q-Learning Algorithms on a simple grid World environment and allow users to compare their performance, Convergence rates and explore the trade-offs between On-policy and Off-Policy Learning.

Text Books:

1. “Reinforcement Learning: An Introduction, “ First Edition, Sutton, Richard S., and Andrew G, Barto, MIT Press 2020”.

2. “Statistical reinforcement learning: modern machine learning approaches,” First Edition, Sugiyama, Masashi. CRC Press 2015.

Suggestive Books:

1. Practical Deep Reinforcement Learning with Python , Ivan Gridin, BPB Publications.
2. “Bandit algorithms,” First Edition, Lattimore, T. and C. Szepesvári. Cambridge University Press. 2020.
3. “Reinforcement Learning Algorithms: Analysis and Applications,” Boris Belousov, Hany Abdulsamad, Pascal Klink, Simone Parisi, and Jan Peters First Edition, Springer 2021.

Online Resources:

1. https://nptel.ac.in/courses/106106143
   https://www.coursera.org/specializations/reinforcement-learning

22CIE58

CYBERSECURITY: ATTACKS & DEFENSES MECHANISM LAB
(Professional Elective- IV Lab)

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

Pre-Requisites

Programming and problem solving, Operating systems, Computer networks, Fundamentals of Cyber Security and Tools, Cryptography and Network Security.

Course Objectives

1. Master techniques for network reconnaissance using tools like Nmap and Wireshark to identify devices and assess security risks posed by open ports.
2. Configure and manage firewall rules using UFW or iptables, and validate their effectiveness using tools such as Nmap, netcat, or Metasploit.
3. Develop secure web applications, employing OWASP ZAP or Burp Suite to identify and mitigate vulnerabilities, and implement best practices in secure coding.
4. Evaluate and enhance wireless network security using Aircrack-ng or Wireshark, with a focus on understanding and implementing WPA2/WPA3 encryption standards.
5. Perform comprehensive vulnerability assessments using OpenVAS or Nessus, prioritize identified vulnerabilities, and apply effective mitigation strategies.

Course Outcomes

By the end of this course, students should be able to:

1. Ability to proficiently conduct network scans and identify devices and open ports, critically analyzing associated security risks.
2. Competence in configuring and managing firewall rules, and effectively testing their robustness against various penetration testing tools.
3. Skill in developing and testing secure web applications, implementing secure coding practices, and addressing vulnerabilities using leading security assessment tools.
4. Understanding and practical application of wireless network security principles, including encryption standards and configurations.
5. Capability to perform vulnerability scans, prioritize identified vulnerabilities based on their severity, and implement appropriate remediation actions.

CO-PO& PSO Articulation Matrix

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

List of Experiments

1. Identify network devices and open ports using nmap and Wireshark; discuss security risks of exposed ports.
2. Test the wireless network security using Aircrack-ng or Wireshark; understand WPA2/WPA3 encryption.
3. Run vulnerability scans with OpenVAS or Nessus; identify, prioritize, and mitigate vulnerabilities.
4. Establish a secure VPN with OpenVPN and analyze potential vulnerabilities using Wireshark.
5. Use OpenSSL for encryption/decryption and configure SSL/TLS on a web server.
6. Steps to ensure the Security of any one web browser (Mozilla Firefox/Google Chrome).
7. Secure a database (MySQL/PostgreSQL) and test for SQL injection with SQLMap.
8. Create a web scraper in Python to gather data from websites.
9. "How to make strong passwords" and "password cracking techniques".

Textbooks:

1. "Nmap Network Scanning: The Official Nmap Project Guide to Network Discovery and Security Scanning" by Gordon Fyodor Lyon, Nmap Project, 2009.
2. "Wireshark Network Analysis (Second Edition): The Official Wireshark Certified Network Analyst Study Guide" by Laura Chappell, Gerald Combs, 2012.
3. "The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws" by Dafydd Stuttard and Marcus Pinto, Second Edition, Wiley, 2011.
4. "Metasploit: The Penetration Tester's Guide" by David Kennedy, Jim O'Gorman, Devon Kearns, Mati Aharoni, 2011.

Reference Books

1. "Practical Malware Analysis: The Hands-On Guide to Dissecting Malicious Software" by Michael Sikorski, Andrew Honig, 2012.
2. "Network Security with OpenSSL: Cryptography for Secure Communications" by John Viega, Matt Messier, Pravir Chandra, 2002.
3. "Bulletproof SSL and TLS: Understanding and Deploying SSL/TLS and PKI to Secure Servers and Web Applications" by Ivan Ristic, 2014.
4. "Mastering OpenVPN" by Eric F Crist, Jan Just Keijser, 2015.

Web References:

1. OWASP - Open Web Application Security Project: https://owasp.org
2. NIST Cybersecurity Framework: https://www.nist.gov/cyberframework
3. SANS Institute: https://www.sans.org/
4. CIS - Center for Internet Security: https://www.cisecurity.org
5. ISACA: https://www.isaca.org

22ITE12

DEVOPS TOOLS LAB
(Professional Elective-IV Lab)

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

Course Objectives

The objective of this lab is to:

1. Understand the fundamentals of DevOps in the context of software development.
2. Learn version control using Git for efficient code management.
3. Build, test, and deploy applications using Jenkins and Maven.
4. Utilize Docker for containerization of applications.
5. Develop and manage an end-to-end software deployment process.

Course Outcomes

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

1. Apply DevOps principles to streamline software development and delivery.
2. Use version control tools such as Git for collaborative coding and tracking changes.
3. Implement continuous integration and delivery using Jenkins and Maven.
4. Demonstrate containerization techniques using Docker.
5. Describe and execute deployment processes using automation tools like Puppet.

CO-PO& PSO Articulation Matrix

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

List of Experiments:

S.No	Experiment Title
1.	To understand DevOps: Principles, Practices, and DevOps Engineer Role and Responsibilities.
2.	Explore the Version Control System tools for Source Code Management.,
3.	Install git and create a GitHub account and To execute various GIT operations.
4.	Installing and configuring Jenkins to set up a build job will help you comprehend continuous integration.
5.	To understand Jenkins Master-Slave Architecture and scale your Jenkins standalone implementation by implementing slave nodes.
6.	To understand Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with containers.
7.	To learn Docker file instructions, build an image for a sample web application using Docker file.
8.	Deploy a containerized application on Kubernetes cluster.
9.	To install and Configure Pull based Software Configuration Management and provisioning tools using Puppet.
10.	To learn Software Configuration Management and provisioning using Puppet Blocks(Manifest, Modules, Classes, Function)

TEXT BOOKS:

1. Len Bass, Ingo Weber and Liming Zhu, DevOps: A Software Architect's Perspective, Addison- Wesley, Pearson Publication, Second Edition, 2015.
2. Mikael Krief, Learning DevOps: A comprehensive guide to accelerating DevOps culture adoption with Terraform, Azure DevOps, Kubernetes, and Jenkins, Packt Publishing , 2022.

REFERENCE BOOKS:

1. Mastering Puppet 5: Optimize enterprise-grade environment performance with Puppet, Ryan Russell and Jason Southgate, Packt Publishing ,2018.
2. Joakim Verona, Practical DevOps, Packt Publishing , 2018.

22ITE14

UNMANNED AERIAL VEHICLES LAB
(Professional Elective-IV Lab)

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

Course Objectives:

This course aims to

1. Understand the basic components of Unmanned aerial vehicles (Drones) and its various applications.
2. Provide hands-on experience on design, fabrication and flying of UAV-category aircraft.
3. Integration of drones with other hardware and software applications.

Course Outcomes:

Upon completing this course, students will be able to:

1. Know the parts and functions of Quad copter.
2. Demonstrate Calibration of UAV(Quadcopter) using Ardupilot Mission planner.
3. Write and test Various commands to communicate for successfully fly the drone.
4. Explore Object Avoidance using sensors and test them on UGV(Robot).
5. Design/Simulate to communicate UAV/UGV using BLE/WiFi/UHF/Cellular devices and IOT-UAV/UGV using text & voice commands.

CO-PO& PSO Articulation Matrix

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

List of Experiments:

1. Assemble, integrate and demonstrate the Quad copter with all necessary parts.
2. Calibration of UAV(Quadcopter) using Ardupilot Mission planner and demonstrate the calibrated IMU parameters
3. Write a program to read Telemetry parameters using Serial Port using TTC device.
4. Write a program to read GPS coordinates on Raspberry Pi and Arduino micro controller
5. Write a program to send MAVLINK commands to Pixhawk version of Flight Controller
6. Write a program to connect Dronekit for communication and testing various commands
7. Use Mission planner for flight path panning and demonstrate the transfer of planning transects to flight controller
8. Write object avoidance program using the following sensors and test them on UGV(Robot)
   a. Sonar b) LiDAR c) Camera
9. Write a Program to communicate UAV/UGV using BLE/WiFi/UHF/Cellular devices
10. Write a program to communicate IOT-UAV/UGV using text & voice commanding for Swarm

Programming Languages

- Python
- C

Software Tools

- Ardupilot Mission Planner
- SITL / MAVproxy
- ROS : Robotic Operating System
- ChibiOS or latest Embedded RTOS

Text Books:

1. K.S. Fu, R.C. Gonzalez, C.S.G. Lee, Robotics : Control, Sensing, Vision and Intelligence
2. John J. Craig, Introduction to Robotics: Mechanics and Control, Addison Wesley publication, 3rd Edition.
3. Reg Austin"Unmanned Aircraft Systems: UAVS Design, Development and Deployment" John Wiley & Sons, Ltd.2011.
4. Fahlstrom P, Gleason T (2012) "Introduction to UAV systems", 4th edn. Wiley, UK
5. Yang, L. J., & Esakki, B. (2021). Flapping Wing Vehicles: Numerical and Experimental Approach. CRC Press.
6. Sebbane, Y. B. (2022). A first course in aerial robots and drones. CRC Press.

Suggested Reading:

1. J.A.M. Mendoza, V.J.G. Villela, G.S. Cervantes, M.M. Martinez, H.S. Azuela, Advanced Robotic Vehicles Programming: An Ardupilot and Pixhawk Approach, First Edition, A Press, 2020
2. Ty Audronis, Designing Purpose-Built Drones for Ardupilot Pixhawk 2.1: Build drones with Ardupilot, First Edition, CBS Publishers and Distributers, 2017
3. J. Ranga, J. Saiteja, M. Seshu, Speed Control of BLDC Motor with RPM Display, First Edition, LAP Lambert Academic Publishing, 2020
4. D. Hanselman, Brushless Motors: Magnetic Design, Performance, and Control of Brushless DC and Permanent Magnet Synchronous Motors, First Edition, E-Man Press LLC, 2012
5. A. Frazier, K. Singh, Fundamentals of Capturing and Processing Drone Imagery and Data, First Edition, CRC Press, 2021
6. J. Baichtal, Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs, First Edition, QUE Publishers, 2015

Web Resources:

1. https://robu.in/understanding-various-components-used-for-quadcopter-2/
2. https://ardupilot.org/copter/docs/common-imutempcal.html
3. https://ardupilot.org/copter/docs/common-telemetry-port-setup.html
4. https://www.youtube.com/watch?v=OeTxaClOEWs
5. https://www.youtube.com/watch?v=zxjO9q34RLs
6. https://www.youtube.com/watch?v=t4rwKoLmgVI

22ADE15

GENERATIVE AI LAB
(Professional Elective-IV Lab)

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

Course Objectives: This course aims to:

1. Understand the fundamental concepts of generative AI models including, GANs, and transformers.
2. Gain proficiency in implementing generative AI models using TensorFlow or PyTorch.
3. Learn to evaluate and interpret the performance of generative AI models effectively.
4. Explore real-world applications of generative AI across various domains such as image generation and natural language processing.
5. Enhance problem-solving skills by experimenting with different model architectures and datasets in generative AI tasks.

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

1. Design and implement generative models like GANs, VAEs, and U-Net for image synthesis.
2. Apply and evaluate style transfer and diffusion models for high-quality image generation.
3. Fine-tune transformer models like BERT and GPT-2 for diverse natural language processing tasks.
4. Develop intelligent applications using OpenAI APIs and LangChain for retrieval-augmented generation.
5. Explore zero-shot and few-shot learning using advanced prompt engineering techniques for LLMs.

CO-PO & PSO Articulation Matrix

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

LIST OF PROGRAMS:

1. Implement DCGAN and train it on any dataset for image generation.
2. Analyze the performance of WPGAN- GP with vanilla GAN and VAE on any dataset for image generation.
3. Implement a style transfer algorithm using GANs and apply it to images from the CIFAR-10 dataset
4. Implement a basic Unet-based denoising model for image restoration.
5. Use Hugging Face Diffusers library to generate images using Stable Diffusion
6. Analyze the performance output quality of Stable Diffusion vs DALL·E 2
7. Fine tune BERT Transformer for various NLP tasks.
8. Use decoder-only models like GPT-2 for text generation.
9. Utilize the OpenAI API to build a question-answering application powered by GPT-3, allowing users to input questions and receive relevant answers.
10. Explore zero-shot and few-shot learning with OpenAI GPT via API.
11. Perform prompt optimization using OpenPrompt or PromptSource.
12. Use RAG (Retrieval-Augmented Generation) with LLMs using LangChain.

SUGGESTED BOOKS:

1. Steve Tingiris Exploring GPT-3, Packt Publishing Ltd. Uk, 2021
2. Joseph Babcock Raghav Bali, Generative AI with Python and Tensor flow 2, Packt Publishing Ltd. UK, 2021

3. Sabit Ekin, Prompt Engineering for Chat GPT: A Quick Guide To Techniques, Tips, and Best Practices, DOI: 10.36227/tech arxiv.22683919.v2, 2023
4. Foster, D. "Generative Deep Learning. Teaching Machines to Paint, Write, Compose and Play (2019)." Beijing-Boston-Farnham-Sebastopol-Tokyo, OREILLY (2019): 330.
5. Hany, John, and Greg Walters. Hands-On Generative Adversarial Networks with PyTorch

22CAC18N

TECHNICAL SEMINAR - AIML

Instruction	2P Hours per Week
Duration of SEE	- Hours
SEE	-Marks
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.

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

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

Each student is required to:

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

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

1. Study and review research papers of new field/areas and summarize them.
2. Identify promising new directions of various cutting edge technologies in Computer Science and Engineering
3. Impart skills to prepare detailed report describing the selected topic/area.
4. Acquire skills to write technical papers/articles for publication.
5. Effectively communicate by making an oral presentation before the evaluating committee.

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.

For the seminar, the student shall collect the information on a specialized topic, prepare a technical report, and submit it to the department. It shall be evaluated by the departmental committee consisting of Head of the Department, seminar supervisor and a senior faculty member. The seminar shall be evaluated for 50 internal marks. There shall be no semester end examination for the seminar.

Note: Topic of the seminar shall preferably be 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 Presentation slides	05
4	Question and Answers	05
5	Report in prescribed format	20

22CAC19N

PROJECT PART - I

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

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

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

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

1. Review the literature related to the problem area / selected topic.
2. Undertake problem identification, formulation and solution.
3. Prepare synopsis of the selected topic.
4. Gather the required data and Set up the environment for the implementation.
5. Conduct preliminary analysis/modelling/simulation experiment.
6. Communicate the work effectively in both oral and written forms.

Guidelines for awarding CIE (Max. Marks: 50)		
Evaluation by	Max. Marks	Evaluation Criteria / Parameter
Supervisor	15	Project Status / Review
Publication	10	In conference/ Journal
Department Review Committee (DRC)	5	Relevance of the Topic
	5	Presentation Slide Preparation
	5	Presentation
	5	Question and Answers
	5	Quality of Report & Report Submission

R22-A

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)
AICTE Model Curriculum R 22-A with effect from AY 2027-28

B.E. CSE (Artificial Intelligence and Machine Learning)

SEMESTER – VIII

S. No	Course Code	Category	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	22****	PEC	Professional Elective-V	3	-	-	3	40	60	3
2	22****	OE	Open Elective-III	3	-	-	3	40	60	3
3	22CEM01		Environmental Science	2	-	-	2	-	50	Non Credit
PRACTICAL										
4	22CAC20N		Project Part- II	-	-	8	-	100	100	4
TOTAL				**8**	**-**	**8**	**-**	**180**	**270**	**10**

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

PE5(T) Semester-VIII		**Open Elective – III (Semester - VIII)**	
22CAE10N	Conversational AI	22EGO03	Indian Traditional Knowledge
22CAE11N	Ethics and AI	22EGO01	Technical Writing Skills
22CAE12N	Machine Translation	22ECO01	System Automation & Control
22CIE53	Blockchain Technology	22MEO05	Research Methodologies and Intellectual Property Rights
22CSE23	Robotic Process Automation		

22CAE10N

CONVERSATIONAL AI
(Professional Elective - V)

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

Course Objectives: The objectives of this course are

1. Understand the basic knowledge of conversational systems and Natural Language for Dialog Systems.
2. Analyse the toolkits that can be used to develop dialogue systems.
3. Addresses open-domain non-task-oriented dialogue systems.
4. Analyse the latest research in neural dialogue systems.
5. Explore the challenges and areas for further development of more intelligent dialogue systems.

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

1. Understand various concepts, issues, and technologies of Conversational AI and Natural Language for Dialog Systems.
2. Understand the Speech Recognition.
3. Understand the Dialog Management and Modelling.
4. Analyse the achievements and issues of ongoing research of neural dialogue system.
5. Make use Neural Dialogue Systems to construct intelligent dialogue systems.

CO-PO & PSO Articulation Matrix

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

Unit I

Introduction to Conversational AI

Introduction to Conversational AI: Introduction to AI assistants and their platforms, Primary use cases for AI assistant technology. Building your first conversational AI: Building a conversational AI for Fictitious Inc, What's the user's intent, and responding to the user.

Natural Language Understanding for Dialog Systems: Spoken Language Understanding (SLU), Frame-based SLU.

Unit II

NLU for Dialog Systems: Classification and Named Entity Recognition.

Speech Recognition: Dialogue System Components, General issues in speech processing, Core recognition and synthesis technology, working with commercial speech technology and Privacy issues in working with speech technology.

Unit III

Introducing Dialogue Systems: Dialogue System, History, Present-day Dialogue System, Modeling conversation in dialogue systems.

Rule-Based Dialogue Systems: A typical dialogue systems architecture and Tools for developing dialogue systems and Evaluating Dialogue Systems.

Unit IV

End-to-End Neural Dialogue Systems: Neural Network Approaches to Dialogue Modeling, A Neural Conversational Model, Introduction to the Technology of Neural Dialogue and Open-Domain Neural Dialogue Systems.

Evaluating Dialogue Systems: How to Conduct the Evaluation, Evaluating Task-Oriented Dialogue Systems, Evaluating Open-Domain Dialogue Systems

Unit V

Case Study: Chatbots in healthcare and mental health support, Voice-enabled devices and smart home applications.

Text Books:

1. Andrew R. Freed. Conversational AI: Chatbots that work.
2. Michael McTear . Conversational AI: Dialogue Systems, Conversational Agents, and Chatbots (Synthesis Lectures on Human Language Technologies).
3. Dan Jurafsky and James H. Martin. Speech and Language Processing (3rd ed. draft).
4. Yoav Goldberg. Neural Network Methods for Natural Language Processing.

Reference (s):

1. Xiaoquan Kong , Guan Wang . Conversational AI with Rasa by Packt.
2. Stephan Bisser . Microsoft Conversational AI Platform for Developers End-to-End Chatbot Development from Planning to Deployment.
3. Lee Boonstra . The Definitive Guide to Conversational AI with Dialogflow and Google Cloud build advanced enterprise chatbots, voice.

Online resources:

1. https://hao-cheng.github.io/ee596_spr2019/
2. https://github.com/search?q=conversational+AI+dialogue+systems&type=repositories
3. https://deeppavlov.ai/
4. https://github.com/jyguyomarch/awesome-conversational-ai

22CAE11N

ETHICS AND AI
(Professional Elective - V)

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

COURSE OBJECTIVES:

1. To understand the fundamentals of ethics and morality related to Artificial Intelligence and its societal impact.
2. To explore ethical issues, standards, regulations, and professional responsibilities in AI applications and intelligent systems.
3. To examine the challenges, global strategies, and opportunities concerning AI ethics and responsible AI deployment.

COURSE OUTCOMES: On Successful completion of this course, student will be able to

1. Explain the concepts of morality and ethics in AI and their societal impact.
2. Analyze ethical issues, harms, and initiatives in real-time AI applications.
3. Evaluate AI standards and regulations, including agent design and safe autonomous systems.
4. Interpret and apply Roboethics and moral theories in professional contexts.
5. Assess the societal implications of AI and compare national and international AI strategies.

CO-PO & PSO Articulation Matrix:

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

UNIT I
INTRODUCTION

Definition of morality and ethics in AI-Impact on society-Impact on human psychology-Impact on the legal system-Impact on the environment and the planet-Impact on trust

UNIT II

ETHICAL INITIATIVES IN AI International ethical initiatives-Ethical harms and concerns-Case study: healthcare robots, Autonomous Vehicles , Warfare and weaponization.

UNIT III

AI STANDARDS AND REGULATION

Model Process for Addressing Ethical Concerns During System Design - Transparency of Autonomous Systems- Data Privacy Process- Algorithmic Bias Considerations - Ontological Standard for Ethically Driven Robotics and Automation Systems

UNIT IV
ROBOETHICS: SOCIAL AND ETHICAL IMPLICATION OF ROBOTICS

Robot-Roboethics- Ethics and Morality- Moral Theories-Ethics in Science and Technology - Ethical Issues in an ICT Society- Harmonization of Principles- Ethics and Professional Responsibility- Roboethics Taxonomy.

UNIT V
AI AND ETHICS- CHALLENGES AND OPPORTUNITIES

Challenges - Opportunities- ethical issues in artificial intelligence- Societal Issues Concerning the Application of Artificial Intelligence in Medicine- decision-making role in industries-National and International Strategies on AI.

TEXT BOOKS:

1. Y. Eleanor Bird, Jasmin Fox-Skelly, Nicola Jenner, Ruth Larbey, Emma Weitkamp and Alan Winfield ,"The ethics of artificial intelligence: Issues and initiatives", EPRS | European Parliamentary Research Service Scientific Foresight Unit (STOA) PE 634.452 – March 2020
2. Patrick Lin, Keith Abney, George A Bekey," Robot Ethics: The Ethical and Social Implications of Robotics", The MIT Press- January 2014.
3. Larry A. DiMatteo, Cristina Poncibò, Michel Cannarsa "The Cambridge Handbook of Artificial Intelligence" Cambridge University Press, July 2022

REFERENCES:

1. Towards a Code of Ethics for Artificial Intelligence (Artificial Intelligence: Foundations, Theory, and Algorithms) by Paula Boddington, November 2017
2. Mark Coeckelbergh," AI Ethics", The MIT Press Essential Knowledge series, April 2020
3. Michael J. Quinn. "Ethics for the Information Age" 6th edition Pearson.

Web links:

1. https://sci-hub.mksa.top/10.1007/978-3-540-30301-5_65
2. https://www.scu.edu/ethics/all-about-ethics/artificial-intelligence-and-ethics-sixteen-challenges-and-opportunities/
3. https://www.weforum.org/agenda/2016/10/top-10-ethical-issues-in-artificial-intelligence/
4. https://sci-hub.mksa.top/10.1159/000492428

NPTEL COURSES:

1. Ethics in engineering practice: https://onlinecourses.nptel.ac.in/noc24_mg131/preview

22CAE12N

MACHINE TRANSLATION
(Professional Elective - V)

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

Prerequisite: Probability and Statistics, Linguistics and NLP Concepts

Course Objectives: The objectives of this course are

1. Understand the theoretical and linguistic foundations of machine translation.
2. Explore statistical and neural approaches for building MT systems.
3. Develop practical skills in implementing and evaluating MT pipelines.
4. Gain exposure to transformer models and real-world deployment.
5. Analyse multilingual translation challenges, ethical concerns, and current research trends..

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

1. Understand historical developments and foundational principles of MT.
2. Analyse and implement Statistical and Neural MT models.
3. Apply transformer-based architectures and modern evaluation metrics.
4. Build and deploy machine translation systems using open-source toolkits.
5. Critically examine recent advancements, multilingual models, and research challenges in MT.

CO-PO & PSO Articulation Matrix:

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1														
CO2														
CO3														
CO4														
CO5														

UNIT- I:

Foundations of Machine Translation: History and evolution of machine translation, key linguistic challenges in translation, language typology and translation difficulties, word alignment basics, phrase-based models and decoding strategies, evaluation metrics (BLEU, METEOR, TER, etc.), introduction to MT corpora, and overview of industrial applications.

UNIT-II

Statistical Machine Translation (SMT):Language models (n-gram, smoothing, perplexity), translation models (noisy channel formulation), IBM alignment models I–V, expectation maximization in MT, phrase extraction and scoring, decoding algorithms and pruning, tuning methods (Minimum Error Rate Training), and limitations of SMT.

UNIT-III:

Neural Machine Translation (NMT): Sequence-to-sequence architecture with RNNs, word embeddings and vocabulary strategies, encoder-decoder framework, attention mechanisms (Bahdanau), loss functions and training objectives, beam search decoding, data preprocessing and batching, and transfer learning with multilingual pretraining.

UNIT-IV :

Transformer Models and Industrial Systems: Transformer architecture, positional encoding, and multi-head attention, comparison of RNN vs Transformer vs CNN-based NMT, large-scale training strategies, popular

toolkits (Fairseq, HuggingFace, OpenNMT), deployment and serving techniques, evaluation beyond BLEU (COMET, BLEURT), and industrial MT pipelines.

UNIT-V

Advanced Topics and Case Studies: Multilingual Neural Machine Translation (MNMT), Prompting and Fine-Tuning Large Language Models for Translation.

Case Studies: Healthcare Translation Systems and Legal and Government Translation Pipelines.

Text Books / Suggested Reading:

1. Philipp Koehn – Statistical Machine Translation, Cambridge University Press, 2009.
2. Koehn, P. – Neural Machine Translation, Cambridge University Press, 2020. https://doi.org/10.1017/9781108608480
3. Yao Fu & Graham Neubig – Machine Translation: Foundations, Advances, and Challenges, 2024.

Related Text Books

1. Thomas Wolf et al. – Natural Language Processing with Transformers, O'Reilly Media, 2022.
2. Delip Rao & Brian McMahan – Natural Language Processing with PyTorch, O'Reilly Media, 2019.
3. Denis Rothman – Transformers for Natural Language Processing (2nd Edition), Packt Publishing, 2022.
4. Jacob Eisenstein – Natural Language Processing, MIT Press, 2019.
5. Ian Goodfellow, Yoshua Bengio, and Aaron Courville – Deep Learning, MIT Press, 2016.
6. Sasha Rush – The Annotated Transformer (Online Resource), Harvard NLP. https://nlp.seas.harvard.edu/annotated-transformer

22CIE53

BLOCKCHAIN TECHNOLOGY
(Professional Elective - V)

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

Prerequisites: Distributed systems, Computer networks and Basic understanding of programming concepts.

Course Objectives:

1. To get acquainted with the foundations of blockchain.
2. To provide the significance of the bitcoin ecosystem.
3. To explore the consensus mechanisms and technologies that support Ethereum.
4. To introduce Hyperledger Fabric and its architecture.
5. To familiarize blockchain use cases in various domains.

Course Outcomes:

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

1. Understand the significance of distributed systems and blockchain.
2. Explain the concepts of bitcoin and consensus mechanisms in bitcoin mining.
3. Explore the consensus mechanisms and technologies that support Ethereum.
4. Describe Hyperledger Fabric architecture and Hyperledger projects.
5. Analyse blockchain use cases in various domains.

CO-PO & PSO Articulation Matrix:

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

Unit –I

Blockchain Foundations: Overview of distributed systems, Introduction to blockchain, Generic elements of a blockchain, Features of blockchain, Applications of blockchain, Hash Functions and Merkle Trees, Components of blockchain Ecosystem, Cryptography and Consensus Algorithms, Types of blockchain, Blockchain Platforms.

Unit –II

Bitcoin Platform: Bitcoin definition, Keys and addresses, Public keys and Private keys in bitcoin, The transaction life cycle, The transaction structure, Bitcoin payments, Consensus mechanism in bitcoin, Wallet types, Non-deterministic wallets, Deterministic wallets, Alternative Coins: Namecoin, Litecoin, Zcash.

Unit –III

Ethereum Blockchain: Introducing Smart Contracts, Ethereum blockchain, The Ethereum stack, Ethereum virtual machine (EVM), Consensus mechanism in Ethereum, The Ethereum network, Ethereum Development, Setting up a development environment, Development tools: Remix IDE, Truffle, Ganache.

Unit –IV

Hyperledger Fabric: Introduction to Hyperledger Fabric, Hyperledger Fabric architecture, Membership services, Hyperledger Projects: Fabric, Sawtooth, Iroha, Components of the Fabric, Alternate blockchains- Ripple, Corda, Hyperledger Smart Contracts (Chaincode).

Unit –V

Case studies using blockchain: Cross border payments, Know Your Customer (KYC), Food supply chain, Mortgage over blockchain, Identity on blockchain, Blockchain in Insurance Industry, Education, Healthcare, Real estate management and Metaverse.

Text Books:

1. Imran Bashir, “Mastering Blockchain - A technical reference guide to the inner workings of blockchain, from cryptography to DeFi and NFTs”, Packt Publishing Ltd, Fourth Edition, 2023.
2. Melanie Swan, "Blockchain: Blueprint for a New Economy", First Edition, O'Reilly, 2018.

Suggested Reading:

1. Andreas M. Antonopoulos, “Mastering Bitcoin Unlocking Digital Cryptocurrencies”, First Edition Apress, 2017.
2. Ritesh Modi, “Solidity Programming Essentials: A Beginner’s Guide to Build Smart Contracts for Ethereum and BlockChain”, Packt Publishing, 2019.
3. Ramchandra Sharad Mangrulkar, Pallavi Vijay Chavan, “Blockchain Essentials - Core Concepts and Implementations”, APress Publishing, 2024.

Online Resources:

1. https://andersbrownworth.com/blockchain/public-private-keys/
2. https://www.hyperledger.org/projects/fabric
3. NPTEL courses:
4. Blockchain and its Applications,
5. Blockchain Architecture Design and Use Cases

22CSE23

ROBOTIC PROCESS AUTOMATION
(Professional Elective - V)

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

Prerequisite: -

Course Objectives:
This course aims to:

1. Provide insights on robotic process automation (RPA) technology and its value proposition
2. Introduce different platforms for RPA
3. Learn different types of variables, control flow and data manipulation techniques
4. Familiarize with Image, Text and data Tables Automation
5. Describe various types of Exceptions and strategies to handle them.

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

1. Gain insights into Robotic Process Automation Technology
2. Acquire knowledge of RPA Platforms and components
3. Identify and understand Image, Text and Data Tables Automation
4. Understand various control techniques and OCR in RPA
5. Describe Exception Handling and Debugging techniques

CO-PO & PSO Articulation Matrix

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

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 OCR- 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 useData table usage with examples Clipboard Management-File operation with step-by-step exampleCSV/Excel to data table and vice versa [with a step-by-step example).

UNIT–IV

Handling Events -Taking Control of the Controls- Finding and attaching windows- Finding the 08 controlTechniques for waiting for a control- Act on controls - mouse and keyboard activities- Working with Ui Explorer- Handling eventsRevisit recorder- Screen Scraping- When to use OCR- Types of OCR availableHow to use OCR- 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, Industry Use case, Future of RPA.

Text Books:

1. Tom Taulli, ―The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems‖, Apress Publishing, 2020
2. Alok Mani Tripathi, ―Learning Robotic Process Automation‖, Packt Publishing, 2018.

Suggested Reading:

1. Richard Murdoch, Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks & Become an RPA Consultant, Independently Published, 1st Edition 2018.
2. Frank Casale , Rebecca Dilla, Heidi Jaynes , Lauren Livingston, ―Introduction to Robotic Process Automation: a Primer‖, Institute of Robotic Process Automation,1st Edition 2015.
3. Srikanth Merianda,‖Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation‖, Consulting Opportunity Holdings LLC, 1st Edition, 2018

Online Resources:

1. https://www.uipath.com/rpa/robotic-process-automation
2. https://www.academy.uipath.com

22EGO03

INDIAN TRADITIONAL KNOWLEDGE
(Open Elective – III)

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

Prerequisite: Knowledge of Indian Culture.

Course Objectives:
This course aims to:
1. To get a knowledge in Indian Culture.
2. To know Indian Languages and Literature and the fine arts in India
3. To explore the Science and Scientists of Medieval and Modern India.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Understand philosophy of Indian culture.
2. Distinguish the Indian languages and literature.
3. Learn the philosophy of ancient, medieval, and modern India.
4. Acquire the information about the fine arts in India.
5. Know the contribution of scientists of different eras.

CO-PO & PSO Articulation Matrix

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

UNIT I
Culture and Civilization: Culture, Civilization and heritage, general characteristics of culture, importance of culture in human life, Cultural diversity, Aesthetics, Women seers, Indus culture, Indian Cuisine, Martial arts.

UNIT II
Education System: Education in ancient, medieval and modern India, aims of education, subjects, Languages, Science and Scientists of ancient. Medieval and modern India. Concepts of Sciences in Indian Knowledge Systems.

UNIT III
Linguistic Wealth: Indian languages and Literature: The role of Sanskrit, Morphology and brevity of Sanskrit, Concepts of NLP in IKS. Paleography, Fundamentals of Vedic Mathematics, Significance of scriptures to current society, Indian semantics and lexicography, Darshanas.

UNIT IV
Art, Technology & Engineering: Sculpture, Painting and Handicrafts, Indian Music, Dance Drama and Theatre, introduction to Mayamatam, Iron and Steel technology, Use of metals in medicinal preparations.

UNIT-V
Science and Logic: Heliocentric system, Sulbasutras, Katapayadi, Engineering in Vedas, Adaptability of Sanskrit in Computer languages, Related commands Hindu calendar, 6 Pramanas in Indian logic, Scientific method applied to therapeutics, Fallacies, Tarka- Induction and deduction, Ayurvedic biology, Definition of health.

Text Books:

1. B. Madhavan, Nagendra Pavana, Vinayak Rajat Bhat, "Introduction to Indian Knowledge System: Concepts and Applications", PHI Learning, June 2022.
2. Kapil Kapoor, "Text and Interpretation: The Indian Tradition", D K Print World Ltd., 2005.
3. Samskrita Bharati, "Science in Sanskrit",2017.
4. Satya Prakash, "Founders of sciences in Ancient India", Govindram Hasanand, 1986.

Suggested Reading:

1. Brajendranath Seal, "The Positive Sciences of the Ancient Hindus", Motilal Banarasidass, 2016.
2. Kancha Ilaiah, "Turning the Pot, Tilling the Land: Dignity of Labour in Our Times", Navayana, 2019.
3. Balram Singh and others, "Science & Technology in Ancient Indian Texts", D.K. Print World Ltd, 1st edition, 2012.
4. Smt. Kalpama Paranjepe, "Ancient Indian insight and Modern Science", Bhandarkar Oriental Research Institute, 1996.
5. Pradeep Parihar, "Vedic World and Ancient Science", World House Book Publishing, 2021.

22EGO01

TECHNICAL WRITING SKILLS
(Open Elective – III)

(Open Elective -BE/B.Tech - Common to all Branches)

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

Prerequisite: Language proficiency and the ability to simplify complex technical concepts for a diverse audience.

Course Objectives:

The course will introduce the students to:

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:

After successful completion of the 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.

CO-PO & PSO Articulation Matrix

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

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.

Textbooks:

1. Meenakshi Raman & Sangeeta Sharma, "Technical Communications-Principles and Practice", Oxford University Press, Second Edition, 2012.
2. 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

22ECO01

SYSTEM AUTOMATION AND CONTROL
(Open Elective – III)

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

Prerequisite: Knowledge about physical parameters in industry is required

Course Objectives:
This course aims to:
1. Learn the concepts industrial control systems
2. Learn how to measure the physical parameters in industry
3. Learn the applications of Robots in industry.

Course Outcomes:
After completion of this course, students will be able to:
1. Understand the features of various automatic and process control systems.
2. Define and analyze various measuring parameters in the industry.
3. Compare performance of various controllers (P, PD, PI, and PID).
4. Illustrate the role of digital computers in automation.
5. Develop various robot structures for different applications.

CO-PO & PSO Articulation Matrix

PO/PSO/CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO1	PSO2	PSO3
CO 1	2	2	3	2	2	1	-	1	-	-	2	1	1	1
CO 2	3	3	3	2	1	1	-	1	-	-	1	1	1	1
CO 3	3	3	3	3	2	1	-	1	-	-	2	1	1	1
CO 4	2	2	2	2	2	2	-	1	-	-	2	1	1	1
CO 5	3	3	3	3	2	2	-	2	-	-	1	1	1	1

UNIT-I
Introduction to Automatic Control Systems: Purpose of Automatic Control, How an Industrial Control System is implemented, Introduction to Automatic Control theory.
Sensors: Sensor definition, Different types of Sensors:Motion, Position, Force, Level sensors, and Thermo couples.

UNIT-II
Theory of Measurements: Measurement goals and concepts, Scale factor, Linearity, accuracy, Range, Resolution, Precision and repeatability.
Measurement Techniques and Hardware: Typical Sensor outputs, Bridge measurements: General equation for bridge balance, Resistance balanced Wheatstone bridge, Variable voltage type measurements, Frequency type measurements.

UNIT-III
Process Controllers: What is a Controller, uses of Controllers, Open loop and closed loop Control, proportional, Analog and Digital methods of Control.
Controller Hardware: Analog and Digital Controllers, Pneumatic controllers, Integral, derivative, PI,PD,PID controllers.

UNIT-IV

Digital Computers as Process Controllers: Introduction, Information required by the computer, Information required by the process, Computer Interface electronics, Digital Computer input-output, computer processing of data, Digital Process control computer design, Computer programming.

Actuators: Electro mechanical - Linear motion and rotary motion solenoids, DC motors, AC motors and Stepped motors.

UNIT-V

Robots: What are robots, Robots and process Control systems, Degrees of freedom, factories of the future, Delivery, Disposal and transport systems, Sensing elements, Robot Classifications and Applications. Trouble shooting System failures: Preliminary steps and other troubleshooting aids.

Text Books:

1. Ronald P. Hunter, "Automated process control systems – concepts and Hardware", 2/e, PHI, 1987.
2. Norman A. Anderson, "Instrumentation for process measurement and Control", 3/e, CRC Press, 2005.

Suggested Reading:

1. Kuo B. C, "Automatic Control Systems", 9th edition
2. A.K Sawhney,"A course on Electrical and Electronic Measurements and Instrumentation".

22MEO05

RESEARCH METHODOLOGIES AND INTELLECTUAL PROPERTY RIGHTS
(Open Elective - III)

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

Prerequisite: Nil

Course Objectives: This course aims to
1. Make the students to formulate the research problem
2. Identify various sources for literature review and data collection.
3. Prepare the research design
4. Equip the students with good methods to analyze the collected data
5. Introduce students to the concepts of innovation

Course Outcomes: Upon completion of this course, the 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. Collect and analyze the data using statistical techniques.
5. Apply creative thinking and innovative skills.

CO-PO & PSO Articulation Matrix

PO/PSO/CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO1	PSO2	PSO3
CO 1	1	2	1	1	-	1	-	1	2	2	2			
CO 2	-	2	1	2	1	1	1	1	3	2	2			
CO 3	1	2	3	2	2	1	-	1	2	-	1			
CO 4	2	2	-	3	2	-	-	-	2	1	1			
CO 5	2	2	3	2	3	1	-	-	-	-	3			

UNIT – I:
Research Methodology: Objectives, Motivation and Significance of Research, Types of Research, Research Methods versus 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 and tertiary, Assessment of Quality of Journals and Articles, Information through Internet
Research writing: Format of the Research report, Writing a Synopsis, Dissertation, Research Proposal and Research Report

UNIT – III
Research Design: Meaning and Need of Research Design, Terminology used in Research Design, Features of a Good Research Design, Formulation of hypothesis, **O**perationalizing the research question, Different Research Designs – exploratory, descriptive, diagnostic and hypothesis testing research studies, Basic Principles of Experimental Design, Steps in Sample design

UNIT – IV
Data Collection and Analysis: Collection of primary dataObservation, Interview and Questionnaire methods, Secondary data, Measures of central tendency, Measures of dispersion, Measures of asymmetry, Important parametric tests z, t, F, ChiSquare, ANOVA significance.

UNIT – V

Innovation: Creativity, Innovation and its difference, Blocks for creativity and innovation, overcoming obstacles, Examples of innovation, Being innovative, Steps for Innovation, right climate for innovation, Design led innovation, Gross root innovation, Frugal and flexible approach to innovation.

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. The Art of Innovation, Tom Kelley & Jonathan Littman, Profile Books Ltd, UK, 2008

Suggested Reading:

1. Vijay Upagade and Aravind Shende, "Research Methodology", S. Chand & Company Ltd., New Delhi, 2009.
2. G. Nageswara Rao, "Research Methodology and Quantitative methods", BS Publications, Hyderabad, 2012.
3. JUGAAD Innovation, Navi Radjou, Jaideep Prabhu, Simone Ahuja Random house India, Noida, 2012.

Online Resources:

1. https://archive.nptel.ac.in/courses/127/106/127106227/
2. https://archive.nptel.ac.in/courses/107/101/107101088/

22CEM01

ENVIRONMENTAL SCIENCE

Instruction	2L Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	0 Marks
Credits	Non-Credit

Course Objectives: To enable the students to

1. Identify environmental problems arising due to engineering and technological activities and the science behind those problems.
2. Become aware about the importance of eco system and biodiversity for maintaining ecological balance.
3. To identify the importance of interlinking of food chain.
4. Learn about various attributes of pollution management and waste management practices.
5. To make the students contribute for capacity building of nation for arresting and/or managing environmental disasters.

Course Outcomes: At the end of the course, student is able to

1. Identify various natural resources and effects of their over utilization.
2. Outline the working mechanism of ecosystem.
3. Illustrate the importance of bio-diversity conservation.
4. Identify remediation measures for environmental pollution through legislations.
5. Explain environmental issues and possible sustainable solutions.

CO-PO & PSO Articulation Matrix

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

UNIT- I:

Environmental Studies: Definition, Scope and importance, need for public awareness.

Natural resources: Use and over utilization of Natural Resources - Water resources, Food resources, Forest resources, Mineral resources, Energy resources, Land resources.

UNIT – II:

Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, role of producers, consumers and decomposers, energy flow in an ecosystem, food chains, food webs, ecological pyramids, Nutrient cycling, Bio-geo chemical cycles, Terrestrial and Aquatic ecosystems.

UNIT – III:

Biodiversity: Genetic, species and ecosystem biodiversity, Bio-geographical classification of India, India as a Mega diversity nation. Values of biodiversity, hot-spots of biodiversity, threats to biodiversity, endangered and endemic species of India, methods of conservation of biodiversity.

UNIT – IV:

Environmental Pollution: Cause, effects and control measures of air pollution, water pollution, marine pollution, soil pollution, noise pollution and Solid waste management, nuclear hazards

Environmental Legislations: Environment protection Act, Air, Water, Forest & Wild life Acts, issues involved in enforcement of environmental legislation, responsibilities of state and central pollution control boards

UNIT – V:

Social issues and the environment: Water conservation methods: Rain water harvesting and watershed management, Environmental ethics, Sustainable development and Climate change: Global warming, Ozone layer depletion, forest fires, and Contemporary issues.

Text Books:

1. Y. Anjaneyulu, "Introduction to Environmental Science", B S Publications, 2004.

2. Suresh K. Dhameja, "Environmental Studies", S. K. Kataria & Sons, 2009.

Suggested Reading:

1. C. S. Rao," Environmental Pollution Control Engineering", Wiley, 1991.

2. S. S. Dara, "A Text Book of Environmental Chemistry &Pollution Control", S. Chand Limited, 2006

E Resources:

1. https://onlinecourses.nptel.ac.in/noc23_hs155/preview
2. https://archive.nptel.ac.in/courses/120/108/120108004/

22CAC20N

PROJECT PART – II

Instruction 8P Hours per week
Duration of End Examination -
Semester End Examination 100 Marks
Continuous Internal Evaluation 100 Marks
Credits 4

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

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

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

1. Demonstrate a sound technical knowledge of their selected topic.
2. Design engineering solutions to complex problems utilizing a systematic approach.
3. Conduct investigations by using research-based knowledge and methods to provide valid conclusions.
4. Create/select/use modern tools for the modelling, prediction and understanding the limitation of complex engineering solutions.
5. Communicate with engineers and the community at large in written and oral forms.
6. Demonstrate the knowledge, skills, and attitudes of a professional engineer.

Guidelines for awarding CIE (Max. Marks: 100)		
Evaluation by	Max. Marks	Evaluation Criteria / Parameter
Department Review Committee (DRC)	10	Review 1
	15	Review 2
	25	Report Submission
Supervisor	10	Regularity and Punctuality
	10	Work Progress
	10	Report Preparation
	10	Analytical/ Programming/Experimentation Skills
Publication	10	Quality of the work which may lead to • Publication Submitted/ Published • Products/ Prototypes/Working Models • IPR(Patent) Submitted/ Published • Projects showcased/ Presentations. • Prizes won/ If any like best projects. • Leading to a Start-Up