



An Autonomous College under VTU

DEPARTMENT OF CSE (AI&ML)

**V Semester
Scheme and Syllabus**

With effect from Academic Year 2025-26

VISION :

To be at the frontier of Artificial Intelligence and Machine learning with a focus on innovation, industry needs and to produce global professionals contributing to society.

MISSION :

- 1. Provide a state-of-the-art curriculum and infrastructure** to deliver high- quality education in Artificial Intelligence and Machine Learning.
- 2. Promote high-quality research and higher education** through strong collaborations between industry and academia.
- 3. Inculcate professional ethics and encourage sustainable solutions** for addressing societal challenges.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

Program Educational Objectives (PEOs) of the UG program in CSE (AI & ML) are as follows.

PEO1: Graduates of the program will pursue successful careers in the IT, Artificial Intelligence, and Machine Learning industries.

PEO2: Graduates will be equipped with the knowledge and skills required to excel in postgraduate education.

PEO3: Graduates of the program will design and implement computing solutions that address real-world challenges and societal demands.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1: Apply the the principles of cognitive computing, artificial intelligence, and machine learning to design and develop intelligent systems in the domain of AI & ML engineering.

PSO2: Exhibit strong computational knowledge, hands-on proficiency, and innovative thinking in the field of Artificial Intelligence and Machine Learning.

PSO3: Utilize modern technologies and approaches to effectively solve real-world problems in Machine Learning, Deep Learning, Computer Vision, and NLP.

List of POs as Defined by NBA in Annexure II.

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4).

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5).

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6).

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9).

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8).

Nagarjuna College of Engineering and Technology
Department of CSE (AI&ML)
Scheme of Teaching and Examinations 2025-2026
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2025-26)

V SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours / Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PEC	23CIT531	Fundamentals of Human Computer Interaction	CSE Board	3	0	0	0	03	50	50	100	3
		23CIT532	Fundamentals of Computer vision										
		23CIT533	Cryptography										
2	IPCC	23CII51	Machine Learning	CSE Board	3	0	2	0	05	50	50	100	4
3	IPCC	23CII52	Game Design and Development using Unity 3D	CSE Board	3	0	2	0	05	50	50	100	4
4	PCCL	23CIL54	Data Mining using tools	CSE Board	0	0	2	0	02	50	50	100	1
5	HSMC	23CIT55	Management & Entrepreneurship	CSE Board	3	0	0	0	03	50	50	100	3
6	Seminar	23CIS56	Technical Seminar	CSE Board	0	0	2	0	01	50	50	100	1
7	AEC	23RMP57	Research Methodology & IPR	CSE Board	3	0	0	0	03	50	50	100	3
8	AEC	23ENV58	Environmental Studies And E-Waste Management	CSE Board	1	0	0	0	01	50	50	100	1
9	Mini Project	23CIP59	Mini project on Machine Learning	CSE Board	0	0	4	0	04	50	50	100	2
10	MC	23NS59	NSS	NSS Coordinator	0	0	2	0	00	100	0	100	0
		23PE59	Physical Edu. (Sports and Athletics)	Yoga Coordinator									
		23YO59	YOGA	PE Coordinator									
Total									27	550	450	1000	22

FUNDAMENTALS OF HUMAN COMPUTER INTERACTION

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23CIT531	3:0:0:0	03	IAT:50 &SEE:50	03 Hours	PEC

Pre- Requisites:

Basic Programming Skills: Familiarity with languages like Python, JavaScript, or Java helps in prototyping interfaces and building interactive systems.

Computer Science Fundamentals: Understanding algorithms, data structures, and software engineering principles is useful for system design.

Psychology or Cognitive Science: Insight into how humans perceive, think, and behave is crucial for designing intuitive interfaces.

Design Thinking: A grasp of user-centered design principles and usability heuristics helps in crafting effective user experiences.

Objectives:

Usability and Effectiveness

- Make systems easy to learn and use
- Ensure users can accomplish their tasks accurately
- Minimize errors and maximize efficiency

User-Centered Design

- Focus on users' needs, abilities, limitations, and contexts
- Involve users in the design and development process
- Promote inclusivity through accessible interfaces

Teaching - Learning Process:

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters student's, Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps to improve the students' understanding.

Module - I

Importance of user interface-definition-importance of good design , Benefits of good design , A brief history of screen design . The graphical user interface – popularity of graphics , the concept of direct manipulation , graphical system , characteristics , web user , Interface popularity , characteristics – principles of user interface

08 HOURS

Module - II

Design process- Human interaction with computers , importance of human characteristics human consideration , Human interaction speeds and understanding business junctions. Screen designing : design goals –screen planning and purpose , organising screen elements ordering of screen data and content –screen navigation and flow –visually pleasing composition –amount of information –focus and emphasis –presentation information simply and meaningfully-information retrieval on web –statistical graphics –technological consideration in interface design

08 HOURS

Module - III

Windows – New and navigation schemes selection of window , selection of devices based and screen based controls , components – text and messages , Icons and increases – multimedia , colors , uses problems , choosing colors.

08 HOURS

Module - IV

HCI in the software process , The software life cycle usability engineering Iterative design and prototyping Design focus : prototyping in practice Design rationale Design rules principles to support usability Standards Golden rules and heuristics HCI patterns Evaluation techniques , Goals of evaluation , Evaluation through expert analysis , Evaluation through user participation , choosing an evaluation method , Universal design , Universal design principles Multi-modal interaction

08 HOURS

Module - V

Cognitive models Goal and task hierarchies Design Focus : GOMS saves money Linguistic models The challenge of display-based systems Physical and device models Cognitive architectures Ubiquitous computing and augmented realities ubiquitous computing applications research Design focus : Ambient wood-augmenting the physical virtual and augmented reality Design focus : Shared experience Design Focus : Applications of augmented reality Information and data visualisation Design focus : Getting the size right.

08 HOURS

Assessment Details (Both CIE / IAT and SEE):

Theory Component	IAT-1 after completion 45 to 50% Syllabus	25 Marks
	IAT-2 after completion 95 to 100% Syllabus	25 Marks
	Average of two IATs	25 Marks
	CCE-1	25 Marks
	CCE-2	25 Marks
	Average of two CCEs	25 Marks
Grand Total of CIE Marks (min marks 20 / 50)		50 Marks
SEE conducted for 100 and scaled down to 50 (min marks 18/50)		50 Marks
CIE + SEE (min marks 40)		100 Marks

Course Outcomes :

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

- CO1** Understand to express syntax and semantics in formal notation
- CO2** Employ to apply suitable programming paradigm for the application
- CO3** Design to program in different language paradigms and evaluate their relative benefits
- CO4** Understand the programming paradigms of modern programming languages
- CO5** Understand the concepts of ADT and OOP

Text Books:

Prescribed Text Book					
Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	The Essential guide to user interface design	Wilbert O Galitz	Third	Wiley	2007
2	Human computer Interaction	Alan dix , Janet fincay , Gre Goryd , Abowd , Russell Bealg ,	Third	Pearson	2009

Reference Books:

Reference Text Book					
Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Human-computer interaction	D.R.Olsen	Second	Pearson	2009
2.	Interaction design	Jenny preece , Rogers , Sharps	Fifth	Wiley	2007
3.	User Interface design	Soren Lauesen	Third	Pearson	2005

CO-PO Mapping:

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

FUNDAMENTALS OF COMPUTER VISION

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22CIT532	3:0:0:0	3	CIE:50 SEE:50	3 Hours	PCC

Pre-Requisites:

- Basic knowledge of coordinate geometry, linear algebra and probability.
- Basic knowledge of Image Processing
- A decent coding skill in a modern language. C++, Matlab and Python ...

Objectives :

1. To introduce various components of image processing techniques for computer vision.
2. To understand filters and computing Image Gradient.
3. To understand segmentation, model fitting and tracking
4. To impart knowledge about object registration and object matching
5. To implement various techniques available for object recognition.

Teaching-Learning Process

These are sample Strategies, used in FCV to accelerate the attainment of the various course outcomes.

1. Chalk and talk
2. Pre-video links of the concept are sent to students well in advance so that students will be able to grasp the topics that is taken in class.
3. After the class quiz is been asked in the class with respect to the topics to know their understanding level and which also promotes critical thinking.
4. After the completion of module hands on is been conducted in the class /lab with respect to the topics to know practically.
their understanding level and which also promotes critical thinking
5. Problem Based Learning (PBL) id adopted, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Every concept can be applied to the real world - and when that's possible, is taught in the class which helps improve the students' understanding.

Module I

Introduction: Image Processing: Pixel transforms, color transforms, histogram processing, histogram equalization, filtering, convolution, Fourier transformation and its applications in sharpening, blurring and noise removal

Overview of computer vision and its applications: Image Formation and Representation: Imaging geometry, radiometry, digitization, cameras and Projections, rigid and affine transformation

08 Hours

Module II		
<p>Feature detection: edge detection, corner detection, line and curve detection, active contours, SIFT and HOG descriptors, shape context descriptors, Morphological operations</p> <p>Segmentation: Active contours, split & merge, watershed, region splitting, region merging, graph-based segmentation, 08 Hours</p>		
Module III		
<p>Camera calibration: camera models; intrinsic and extrinsic parameters; radial lens distortion; direct parameter calibration; camera parameters from projection matrices; orthographic, weak perspective, affine, and perspective camera models. 08 Hours</p>		
Module IV		
<p>Motion representation: The motion field of rigid objects; motion parallax; optical flow, the image brightness constancy equation, affine flow; differential techniques; feature-based techniques; regularization and robust estimation</p> <p>Motion tracking: statistical filtering; iterated estimation; observability and linear systems; the Kalman filter. 08 Hours</p>		
Module V		
<p>Object recognition and shape representation: Alignment, appearance-based methods, invariants, Image Eigen spaces</p>		
Assessment Details (both IAT and SEE)		
Theory Component	IAT-1 after completion 45 to 50% Syllabus	25 Marks
	IAT-2 after completion 95 to 100% Syllabus	25 Marks
	Average of two IATs	25 Marks
	CCE-1	25 Marks
	CCE-2	25 Marks
	Average of two CCEs	25 Marks
Grand Total of IAT Marks (min marks 20 / 50)		50 Marks
SEE conducted for 100 and scaled down to 50 (min marks 18/50)		50 Marks
IAT + SEE (min marks 40)		100 Marks
Course Outcomes		
<p>At the end of the course the student will be able to :</p> <ol style="list-style-type: none"> 1. Understand various image formation models. 2. Extract shape, texture and edge based features. 3. Detect region of interest using image segmentation and object localization techniques. 4. Identify and recognize objects using image registration and classification. <p style="padding-left: 40px;">Explore various case studies on vision based applications</p>		

<p>Text Books:</p> <p>1. Computer Vision: Algorithms and Applications. R. Szeliski, Springer, 1st Edition, Springer, 2011,</p>
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Gilberg & Forouzan, Data Structures: A Pseudo-code approach with C, 2nd Ed, Cengage Learning, 2014. 2. Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014. 5.1 – 5.8, 6.6 – 6.7, 8.3.
<p>E - Resources:</p> <ol style="list-style-type: none"> 1. https://www.cs.princeton.edu/ 2. https://www.opendatastructures.org/ods-cpp 3. https://www.lib.mdp.ac.in/ebook/DSa 4. https://www.cs-fundamentals.com/data-structures/introduction-to-datastructures.php 5. https://www.cprogramming.com/algorithms-and-data-structures.html 6. https://online-learning.harvard.edu/course/data-structures-and-algorithms

CO-PO-PSO Mapping

POs COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PS O 1	PS O 2	PSO 3
CO 1	3											2			2
CO 2		3										2			2
CO 3			2									2			1
CO 4						1				1		1			
Avg	3	3	2			1				1		1.75			1.67

CRYPTOGRAPHY					
Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23CIT533	3:0:0:0	03	IAT:50 SEE:50	03	PEC
Pre- Requisites: <ul style="list-style-type: none"> • Computer Networks • Basics of Cyber security • Mathematical concepts 					
Objectives: <ol style="list-style-type: none"> 1. Define and explain the core concepts of Cryptography. 2. Able to identify the various security mechanisms. 3. Explore the various cryptographic techniques. 4. Analyze the various security attacks and the mitigation techniques. 5. Identify the various security algorithms/ techniques to solve cryptographic problems. 					
Teaching - Learning Process: <ol style="list-style-type: none"> 1. Chalk and Talk method 2. Experience based learning 3. Team teaching method 4. Activity based learning 					
Module - I					
Introduction: Security Goals, Cryptographic Attacks, Service & Mechanisms, Techniques. Mathematics of Cryptography: Integer Arithmetic, Modular Arithmetic, Linear Congruence.					
08 HOURS					
Module - II					
Traditional symmetric-Key Ciphers: Introduction, Substitution Ciphers, Transposition Ciphers. Mathematics of Symmetric-key cryptography: Algebraic Structures, $GF(2^n)$ Fields.					
08 HOURS					
Module - III					
Introduction to Modern Symmetric Key Ciphers: Modern Block Ciphers, Modern Stream Ciphers. Data Encryption Standard (DES): Introduction, DES Structure, DES Analysis, Multiple DES. Advanced Encryption Standard (AES): Introduction, Transformations, Key Expansion, AES Ciphers.					
08 HOURS					
Module - IV					
Mathematics of Asymmetric-Key Cryptography: Primes, Primality Testing, Chinese Remainder Theorem, Quadratic Congruence.					
08 HOURS					
Module - V					
Asymmetric -Key Cryptography: Introduction, RSA cryptosystem, ElGamal Cryptosystem. Cryptographic hash functions, RSA digital signature. Diffie-Hellman Key Agreement.					
08 HOURS					
Assessment Details (Both CIE / IAT and SEE):					
Theory Component	IAT-1 after completion 45 to 50% Syllabus			25 Marks	
	IAT-2 after completion 95 to 100% Syllabus			25 Marks	
	Average of two IATs			25 Marks	

	CCE-1	25 Marks
	CCE-2	25 Marks
	Average of two CCEs	25 Marks
Grand Total of CIE Marks (min marks 20 / 50)		50 Marks
SEE conducted for 100 and scaled down to 50 (min marks 18/50)		50 Marks
CIE + SEE (min marks 40)		100 Marks

Course Outcomes :

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

1. Apply cryptographic techniques to ensure data confidentiality, integrity, and authentication.
2. Analyze various symmetric and asymmetric cryptosystems and types of attacks on these Cryptosystems.
3. Demonstrate cryptography encryption and decryption techniques using CrypTool.

Text Books:

1. "Cryptography and Network Security" Behrouz A. Forouzan and Debdeep Mukhopadhyay 2nd edition Tata McGraw Hill 2013

Reference Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	"Cryptography: Theory and Practice"	Stinson. D.	3rd edition	Chapman & Hall/CRC	2012
2.	"Cryptography and Network Security"	Atul Kahate	3rd edition	Tata McGraw-Hill	2003
3.	"Cryptography and Network Security Principles and practice"	W. Stallings	5 th edition	Pearson Education Asia	2013

E – Resources:

E-Book

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1.	Cryptography and Network Security. Principles and Practice	William Stallings	3 rd edition	Pearson Education	2007	http://williamstallings.com/Crypto3e.html

CO-PO Mapping:

CO-PO-PSO Mapping															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3														3
CO2		3													
CO3				3	3				1	1					

MACHINE LEARNING					
Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23CII51	3:0:2:0	4	IAT:50 SEE:50	3 Hours	IPCC
Pre- Requisites: Basic knowledge of statistics, probability, calculus, linear algebra, and programming knowledge.					
Objectives: This course will enable students to: <ol style="list-style-type: none"> 1. Replicating human learning processes to improve accuracy for specific tasks. 2. Classifying data based on developed models (e.g., detecting spam emails). 3. Making predictions for future outcomes (e.g., predicting house prices). 4. Building algorithms that learn from data to find patterns and make accurate predictions. 					
Teaching - Learning Process: These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes. <ol style="list-style-type: none"> 1. Lecture method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes. 2. Show Video/animation films to explain evolution of communication technologies. 3. Encourage collaborative (Group) Learning in the class 4. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking. 5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it. 6. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them. 7. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding. 					
Module - I					
Introduction to machine learning: Types of Machine learning, supervised learning, unsupervised learning, semi supervised learning, reinforcement learning, Handling – Bad, insufficient and poor quality data and Irrelevant features, Over fitting and Under fitting the data Well Posed Learning System: Designing a learning system, Perspectives, and issues in machine learning, Find-S Algorithm, Candidate elimination Algorithm.					
08 HOURS					
Module - II					
Linear Classifiers: Linear Regression, Multiple Linear Regression, Logistic Regression, K Nearest Neighbours, Decision Trees: ID3, Classification and Regression Trees, Support Vector Machines: Linear and Non-Linear, Kernel Functions.					
08 HOURS					
Module - III					
Probabilistic Learning: Bayes Theorem and Concept Learning, Maximum Likelihood, Minimum Description Length Principle, Bayes Optimal Classifier, Gibbs Algorithm, Bayesian Learning, Naïve Bayes Classifier, Bayesian Belief Network, EM Algorithm.					
08 HOURS					
Module - IV					
Ensemble Learning: Combining multiple learners: Model combination schemes, Voting Classifiers, Bagging and Pasting, Random Patches and Random Subspaces, Random Forests, Boosting, Stacking, Unsupervised learning: Introduction to Clustering, K-means clustering, Dimensionality reduction- Principal Component Analysis.					
08 HOURS					

Module - V

Reinforcement Learning: Introduction, Learning Task, Q Learning, Non deterministic Rewards and actions, temporal-difference learning, Relationship to Dynamic Programming, Active reinforcement learning, Generalization in reinforcement learning.

08 HOURS

Assessment Details (Both CIE / IAT and SEE):

Theory Component	IAT-1 after completion 45 to 50% Syllabus	25 Marks
	IAT-2 after completion 95 to 100% Syllabus	25 Marks
	Average of two IATs	25 Marks
	Total 25 Marks : Reduced to 15 Marks	
	CCE-1	25 Marks
	CCE-2	25 Marks
	Average of two CCEs	25 Marks
Total 25 Marks : Reduced to 10 Marks		
Lab Component	Lab Record and execution of programs	15 Marks
	Lab Test at the end of 15 th week	10 Marks
	Total	25 Marks
Grand Total of CIE Marks (min marks 20 / 50)		50 Marks
SEE conducted for 100 and scaled down to 50 (min marks 18/50)		50 Marks
CIE + SEE (min marks 40)		100 Marks

Course Outcomes :

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

- Apply different learning algorithms for complex problems
- Evaluate the developed learning model for given dataset
- Develop the machine learning model to solve a problem.
- Conduct experiments to solve real-world problems using appropriate machine learning techniques.

PROGRAMS

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training example.
3. Write a program to implement the working of the decision tree based ID3 algorithm.
4. Write a program to demonstrate the working of C4.5 algorithm and validate it.
5. Write a program to implement the Bayesian belief network for a weather dataset.
6. Write a program to demonstrate the working of Naive bayes classifier for a network attack dataset.
7. Write a program to solve a non-label dataset using k-means clustering
8. Write a program to demonstrate the working of random forest algorithm in dataset
9. Consider an undirected graph with 8 points from 0 to 7, 0 -> 1, 1-> 5, 1->2, 5->4, 5->6, 2->3 and 2->7. Your bot is in the position 0 and needs to reach the position 7. Design a q-learning based model to help the bot to reach the position 7.
10. Design a q-learning based model to help the humanoid bot to reach the village near the

GAME DESIGN AND DEVELOPMENT USING UNITY 3D

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22CII52	3:0:2:0	4	CIE:50 SEE:50	3 Hours	IPCC

Pre-Requisites:

- Basics of Programming
- Digital gaming concepts

Objectives :

1. Introducing the concepts of Game Design & Development.
2. Understand Unity Interface and Tools.
3. Understand Game Mechanics and Systems Design.
4. Applying knowledge to Game Publishing & Marketing.

Teaching-Learning Process

These are sample Strategies, used in Game design using Unity to accelerate the attainment of the various course outcomes.

1. Chalk and talk
2. Google site web links of the concept are sent to students well in advance so that students will be able to grasp the topics that is taken in class.
3. After the class quiz is been asked in the class with respect to the topics to know their understanding level and which also promotes critical thinking.
4. Experience Based Learning (EBL) id adopted, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Every concept can be applied to the real world - and when that's possible, is taught in the class which helps improve the students' understanding.

Module I

Introduction to Game Design - Overview, Basics of Computer Graphics -Transformation, Projection, Rendering, Introduction to Unity - Installing unity, Setting up Unity environment and project structure.

Components and Prefabs - Components examples, Adding a Component to an Object, C# functions, Writing our 'Player Controller' Component, Making and Spawning Prefabs, Collision Detection, Turning an Object into a Prefab.

08 Hours

Module II

2D Game Development - Basics of 2D game, 2D vs 3D game, 2D Sandbox, Creating 2D game prototypes in Unity - Sprites, sprite sheets, Tilemaps, 2D assets selection from store, 2D physics and movement, 2D animation, Cinemation camera, The Power of Parallax.

3D game modeling - Working with 3D models, Implementing 3D character controllers and animations - Introduction to lighting and visual effects.

08 Hours

Module III

Advanced game mechanics - Subsystems, Making our health system, Principles of animations, Making a basic animation, The animation view.

Designing and implementing AI behaviors - New Component - AI Brain, Unity events and AI actions, Hunting down the player, Setting up the AI Component, Navmesh & agents.

08 Hours

Module IV

Designing user interfaces (UI) for games - Game Flow vs Gameplay Flow, Game flow breakdown, The Unity UI system, Title Menu - Adding the UI elements, adding scripts, button actions, adding scenes to build settings.

Game Audio - The audio components, Importing Music and SoundFX, Importing Audio clips, Basics of 3D sound.

08 Hours

Module V

Platform and Publishing - Your Platform of Choice, PC/Mac/Linux, Mobile games, Console development, WebGL, AR/VR, Publishing your game, Preproduction - Design docs, Paper prototypes, Concept Art, Project Management.

08 Hours

LIST OF LABORATORY PROGRAMS

Introduction to the basic unity hub installation and set up.

1. Importing of Image target inbuilt type and custom type from Vuforia.
2. Implement Game object manipulation and script writing for basic cube builders.
3. Create a rolling ball game through Unity.
4. Create a Flappy Bird game through Unity.
5. Create a Pong game through Unity.
6. Create a Brick Breaker game through Unity.
7. Create a Endless Runner game through Unity.
8. Create a snake game using Unity.
9. Create a Target Shooting game through Unity.
10. Matlab implementation of Computer Graphics (Image processing and classification)

Assessment Details (both IAT and SEE)

Theory Component	IAT-1 after completion 45 to 50% Syllabus	25 Marks
	IAT-2 after completion 95 to 100% Syllabus	25 Marks
	Average of two IATs	25 Marks
	Total 25 Marks : Reduced to 15 Marks	
	CCE-1	25 Marks
	CCE-2	25 Marks
	Average of two CCEs	25 Marks
	Total 25 Marks : Reduced to 10 Marks	
Lab Component	Lab Record and execution of programs	15 Marks
	Lab Test at the end of 15th week	10 Marks
	Total	25 Marks
Grand Total of IAT Marks		50 Marks
Obtaining 40% of marks in both theory and lab component is essential for appearing for SEE		

Course Outcomes

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

Define and explain the concepts of Data Structures

1. Comprehend the basics of Unity & Game Design.
2. Comprehend the 2D & 3D Game Development.
3. Comprehend the Unity's UI system.
4. Learn advanced game mechanics and System Design.
5. Learn Game publishing and Marketing.

Text Books:

1. "Mastering Game design with Unity 2021" by Scott Tykoski (BPB Publications, 2021)

Textbook : Chapter 1: 1.1 - 1.5; Chapter 2: 2.1 - 2.4; Chapter 3: 3.1 - 3.2; Chapter 4: 4.1 - 4.6; Chapter 7: 7.1 - 7.2; Chapter 8: 8.1 – 8.4; Chapter 10: 10.1 – 10.4; Chapter 15: 15.1 – 15.11; Chapter 17: 17.1 – 17.7, Chapter 18: 18.1 – 18.4.

Reference Books:

1. "Unity in Action: Multiplatform Game Development in C#" by Joe Hocking (Manning Publications, 2018)
2. "Mastering Unity 2D Game Development" by Simon Jackson (Packt Publishing, 2014)
3. "Unity 2D Game Development Cookbook" by Claudio Scolastici (Packt Publishing, 2015)
4. "Unity 3D Game Development by Example" by Ryan Henson Creighton (Packt Publishing, 2018)

E - Resources:

1. <https://learn.unity.com/>
2. <https://community.unity.com/>

CO-PO-PSO Mapping

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	3	-	2	-	3	-	-	-	2	-	-	-	3	2	-
CO 2	-	-	3	2	3	-	-	-	-	-	-	2	3	3	-
CO 3	-	-	3		3	-	-	-	-	3	-	-	2	3	-
CO 4	-	3	3	3	3	2	-	-	-	-	2	-	-	3	-
CO5	-	-	-	2	-	-	2	3	-	3	3	-	-		3
Avg	0.6	0.6	2.2	1.4	2.4	0.4	0.4	0.6	0.4	1.2	1.0	0.4	1.6	2.2	0.6

DATA MINING USING TOOLS

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23CIL54	0:0:2:0	01	IAT:50 SEE:50	03 Hours	PCCL

Course Objectives:

- Understand the basic concepts of data mining.
- Gain the knowledge of tools used for data mining
- Understand the working of pre-processing techniques on data set
- Understand the working association and clustering algorithms.

Teaching - Learning Process:

These are sample strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method(L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at-least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world and when that's possible, it helps

Improve the students' understanding.

Programmes

1. Introduction to WEKA Tool
2. Creating new Arff File <https://machinelearningmastery.com/load-csv-machine-learning-data-weka/>
3. a) Pre-Processes Techniques on Data Set
b) Pre-process a given dataset based on Handling Missing Values
4. Generate Association Rules using the Apriori Algorithm
5. Generating association rules using fpgrowth algorithm
6. Build a Decision Tree by using J48algorithm
7. Naïve bayes classification on a given data set
8. Applying k-means clustering on a given data set
9. Calculating Information gains measures.
10. OLAP Cube and its different operations.

Assessment Details (Both CIE / IAT and SEE):**Continuous Internal Assessment of Laboratory/Practical Courses**

LabTest 1	Lab Test 2	Lab Records
15 marks	15 marks	20 marks
Semester End Examination(SEE)		50 marks

Course Outcomes :

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

CO1: Solve data set preprocessing using weka tool.

CO2: Discover interesting pattern from large amount of data .

CO3: Design and Deploy appropriate Classification Techniques.

CO4: Able to cluster high dimensional data

Text Books:

1	Data Mining Concepts and Techniques	Jiawei Han and Micheline Kamber	Elsevier	2nd Edition 2007
2	Data Warehousing, Data Mining & OLAP	Alex Berson and Stephen J. Smith	Tata McGraw-Hill Education Pvt. Ltd	2004
3	Introduction to Data Mining	Pang-Ning Tan, Michael Steinbach and Vipin Kumar	Person Education	2007

Reference Books:

1	Introduction to Data Mining with Case Studies	G. K. Gupta	Prentice Hall of India,	Easter Economy Edition
2	Data Mining Methods and Models”, Publisher	Daniel T. Larose,	John Wiley & Sons	2006
3	Data Mining	Pieter Adriagus, Dolf Zantinge	Pearson education	2007

E – Resources:

- 1) <https://study.com/academy/lesson/data-warehousing-and-data-mining-information-for-business-intelligence.html>
- 2) <http://myweb.sabanciuniv.edu/rdehkharghani/files/2016/02/The-Morgan-Kaufmann-Series-in-Data-Management-Systems-Jiawei-Han-Micheline-Kamber-Jian-Pei-Data-Mining.-Concepts-and-Techniques-3rd-Edition-Morgan-Kaufmann-2011.pdf>
- 3) <https://www-users.cs.umn.edu/~kumar001/dmbook/index.php>

CO-PO Mapping:

POS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
COs											
CO1					3						
CO2	2	2	2		3						
CO3	3	3	3		3						
CO4	3	3	3		3						

MANAGEMENT AND ENTREPRENEURSHIP

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23CIT55	3:0:0:0	03	IAT:50 SEE:50	03Hours	HSMC

Pre- Requisites:

- Basic knowledge of understanding how businesses operate and how to make them profitable.
- Networking is an essential part of entrepreneurship.

Objectives:

1. To provide a fundamental understanding of management and its functions.
2. To familiarize with the dynamics of organisation and recruitment process.
3. To expose to the importance of controlling and leading in organizations.
4. To enable the students to understand Enterprership
5. To enable the students to understand an appropriate understanding of startups in the Indian context the process of new startup venture creation.

Teaching - Learning Process:

These are sample Strategies, used in FCV to accelerate the attainment of the various course outcomes.

1. Chalk and talk method.
2. Pre-video links of the concept are sent to students well in advance so that students will be able to grasp the topics that is taken in class.
3. After the class quiz is been asked in the class with respect to the topics to know
4. Every concept can be applied to the real world - and when that's possible, is taught in the class which helps improve the students' understanding.

Module - I

Introduction to Management:

Meaning - nature and characteristics of Management, Scope and Functional areas of management
 Management as art or science, art or profession - Management & Administration - Roles of Management.

Planning: Nature, importance and purpose of planning process, objectives - Types of plans (meaning only) - Decision making, planning & planning premises - Hierarchy of plans.

08 HOURS

Module - II

Organizing:

Nature and purpose of organization, Principles of organization – Types of organization-
 Departmentation Committees-Centralization Vs Decentralization of authority and responsibility -
 Span of control - MBO and MBE (Meaning only) ,Nature and importance of **Staffing:** Process of
 Selection & Recruitment (in brief).

08 HOURS

Module - III

Directing:

Meaning and nature of directing, Defining Leadership, Ingredients of Leadership, Trait approaches to
 leadership, Leadership behaviour and style.

Controlling and coordination: Definition, steps in controlling, Essentials of a sound control systems,
 Coordination definition, characteristics, techniques and types.

08 HOURS

Module - IV

Entrepreneurship: Importance of entrepreneurship, concepts of entrepreneurship, characteristics of a
 successful entrepreneur, Types of entrepreneurs, stages in Enterprenuerial process, problems faced by
 entrepreneurs. Enterprenuership in India.

Women Entrepreneurs: Women entrepreneurship defined, women entrepreneurship environment, challenges in the path of women entrepreneurship, strategies for development of women entrepreneurs.

08 HOURS

Module - V

Startups and process of new venture:

Definition And Meaning of Startups, Characteristics, Role, Importance and Present Status In Indian Economy Start-Up Lifecycle, Factors Influencing their Emergence.

Process of new Venture: Legal Requirement, Resource Procurement, Business Models.

08 HOURS

Assessment Details (Both CIE / IAT and SEE):

Theory Component	IAT-1 after completion 45 to 50% Syllabus	25 Marks
	IAT-2 after completion 95 to 100% Syllabus	25 Marks
	Average of two IATs	25 Marks
	CCE-1	25 Marks
	CCE-2	25 Marks
	Average of two CCEs	25 Marks
Grand Total of CIE Marks (min marks 20 / 50)		50 Marks
SEE conducted for 100 and scaled down to 50 (min marks 18/50)		50 Marks
CIE + SEE (min marks 40)		100 Marks

Course Outcomes :

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

1. To understand the role of management at workplace.
2. Apply principles of management into practice.
3. Analyze the importance of communication and leadership in an organization.
4. Assess the need for entrepreneurship and challenges in women entrepreneurship.
5. Develop startups ideas for the development of an Indian economy.

Text Books:

1. Management and Entrepreneurship: N V R Naidu and T Krishnarao International Publishing House 2008.
2. Start up and New venture management: by Prof. Nitin Kamat , Dr. Manik S. Kadam , Dr. Abhay S. Kinikar Dr. Gauri Prabhu

Reference Books:

1. Management fundamentals - Concepts, Application, Skill Development: Author RobersLusier, Thomson Thomson south-wester.
2. Entrepreneurship Development S. S. Khanka, S. Chand & Co 4th Edition Stephen Robbins 2011.

E – Resources:

<https://www.udemy.com/course/management-101/?couponCode=IND21PM>
<https://www.udemy.com/course/management-101/?couponCode=IND21PM>

CO-PO Mapping:

CO/PO	Program Outcomes (PO)											PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	1	1					1	2	2			
CO2	1	1	1	1				2	2	2			
CO3	1	1		1				2	3	3			
CO4	2	2	2	2	1	2	1	1	2	3	2		
Avg	1	1	1	1		1	2	1	2	2	2		

RESEARCH METHODOLOGY AND IPR

Course Code	23RMP57	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

1. To understand the knowledge on basics of research and its types.
2. To learn the concept of literature Review, technical Reading, statistical tools, plagiarism and citations.
3. To learn Ethics in Engineering Research.
4. To discuss the concepts of Intellectual Property Rights, Copy right and Trade mark rights.
5. To learn the basics of intellectual property, copy right and Trade mark rights.
6. To develop proficiency in technical report writing and professional presentation skills. This shall serve the project work course.

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer methods (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module – I

Foundation Of Research: Definitions of Research; Objectives and Motivation in Engineering Research; Criteria for Good Research; Types of Engineering Research; Research Process; Identifying and Solving a Worthwhile Research Problem.

Ethics in Engineering Research: Ethical Practices in Engineering Research; Types of Research Misconduct; Ethical Issues Related to Authorship.

08 Hours

Module – II

Literature Review and Technical Reading: Importance of Literature Review and Technical Reading, New and Existing Knowledge; Analysis and Synthesis of Prior Art; Steps Involved in a Literature Review; Bibliographic Databases — Web of Science, Google, and Google Scholar; Developing a theoretical and conceptual framework; Critical Reading vs. Creative Reading; Taking Notes While Reading.

Attributions and Citations: Giving Credit Wherever Due; Citations — Functions and Attributes; Impact of Title and Keywords on Citations; Knowledge Flow Through Citations; Citing Datasets; Styles for Citations; Acknowledgment and Attribution; Acknowledgements in Books/Dissertation. Dedication of Acknowledgements

08 Hours

Module – III

Interpretation and Report Writing- Meaning of Interpretation; Techniques of Interpretation; Precautions in Interpretation; Significance of Report Writing; Steps in Writing a Report; Layout of a Research Report; Types of Reports; Oral Presentation; Mechanics of Writing a Research Report; Precautions for Writing Research Reports.

Technical Writing and Publishing - Free Writing and Mining for Ideas; Attributes and Principles of Technical Writing; Patent or Technical Paper — Making the Right Choice; Writing Strategies; Journal Paper — Structure and Approach; Language Skills, Writing Style; Publishing Articles to Get Cited.

08 Hours

Module – IV

Intellectual Property Rights and IPR - Introduction to IPR, Patents-Preparing Patent Applications; Patentable and non-patentable inventions; Understanding the Invention (Core Inventive Concept); Inventorship; Typical Parts of a Patent Application — Request, Description, Claims, Drawings, Abstract, and Application Format.

Copyrights and Related Rights: Classes of Copyrights; Criteria for Copyright Protection; Ownership of Copyright; Rights of the Author; Copyright Infringement.

Trademarks: Eligibility Criteria; Acts and Laws Related to Trademarks; Designation of Trademark Symbols; Classification of Trademarks; Registration and Validity of a Trademark; Process for Trademark Registration; Prior Art Search; Types of Trademarks Registered in India.

Famous Case Law: *Coca-Cola Company vs. Bisleri International Pvt. Ltd.*

08 Hours

Module – V

Industrial Designs: Eligibility Criteria; Acts and Laws Governing Industrial Designs; Design Rights; Non-Protectable Industrial Designs in India; Procedure for Registration of Industrial Designs; Application for Registration; Duration of Design Registration; Importance of Design Registration; Cancellation of Registered Designs; Classification of Industrial Designs; International Treaties.

Geographical Indications: Acts, Laws, and Rules Pertaining to Geographical Indications (GI); Ownership of GI; Rights Granted to GI Holders; Registered GIs in India and Their Identification; Classes of GIs.

Case Studies on Patents: *Case study of Curcuma (Turmeric) Patent; Case study of Neem Patent; Case study of Basmati patent.*

08 Hours

Teaching-Learning Process for all modules

Chalk and board, Active Learning, PPT Based presentation, Video

Course Outcomes

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

CO1: **Apply** research concepts and techniques to effectively address research problems.

CO2: **Analyse** literature reviews and databases critically, ensuring proper citation and acknowledgment.

CO3: **Design** and structure internship reports, technical writing, and oral presentations with effective interpretation.

CO4: **Identify** and **discuss** key aspects of intellectual property rights (IPR), emphasizing their importance and processes.

CO5: **Evaluate** case studies and **demonstrate** applying IP laws and ethical standards to real-world engineering and innovation challenges.

Assessment Details (both IAT and SEE)

Theory Component	IAT-1 after completion 45 to 50% Syllabus	25 Marks
	IAT-2 after completion 95 to 100% Syllabus	25 Marks
	Average of two IATs	25 Marks
	CCE-1	25 Marks
	CCE-2	25 Marks
	Average of two CCEs	25 Marks
Grand Total of IAT Marks (min marks 20 / 50)		50 Marks
SEE conducted for 100 and scaled down to 50 (min marks 18/50)		50 Marks
IAT + SEE (min marks 40)		100 Marks

Suggested Learning Resources:**Text Books:**

1. Dr. Santosh M Nejakar, Dr. Harish Bendigeri “Research Methodology and Intellectual Property Rights”, ISBN 978-93-5987-928-4, Edition: 2023-24.
2. C. R. Kothari, Gaurav Garg, “Research Methodology: Methods and Techniques” New Age International, 4th Edition, 2019

Reference Books:

1. David V. Thiel “Research Methods for Engineers” Cambridge University Press, 978-1-107-03488-4
2. Intellectual Property Rights by N.K. Acharya Asia Law House 6th Edition. ISBN: 978-93.
3. Research Methodology by Ranjit Kumar, sage publication 3rd Edition

CO PO Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	1	-	-	-
CO3	-	-	2	-	-	-	-	1	-	-	-	2	-	-	-
CO4	-	-	-	3	-	-	-	1	-	-	-	1	-	-	-
CO5	-	-	-	-	-	2	2	3	3	-	-	1	-	-	-

ENVIRONMENTAL STUDIES AND E-WASTE MANAGEMENT

Course Code	23ENV58	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	18	Total Marks	100
Credits	01	Exam Hours	01

Course Objectives:

1. To recognize fundamental concepts in environmental science and demonstrate a comprehensive understanding of the environment.
2. To understand the pollution in all fronts at local and global level encompassing the issues of carbon credit, ozone level depletion, global warming, desertification and polar ice cap melting.
3. To expose to students to the problems and mitigation measures concerned to the environmental components like resources, air, water and land.
4. Analyze the impact of issues w. r. t. waste and e-waste management to protect the environment

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

- Lecturer method (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
- Use of Video/Animation to explain functioning of various concepts.
- Encourage collaborative (Group Learning) Learning in the class.
- Ask at least three HOT (Higher order Thinking) questions in the class, which promotes Critical thinking.
- Adopt Case study Based Learning (CBL), which fosters students' analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module – I

Ecosystem and Sustainability

Ecosystems:

Structure and types of ecosystems, including forest, desert, wetland, riverine, and oceanic ecosystems.

Ecological succession and interspecific relationships within ecosystems.

Sustainability:

Understanding climate change and its implications for sustainability. Overview of the Sustainable Development Goals (SDGs) and possible actions to achieve them. Concept of carbon footprint (CFP), methods for calculating CFP, and strategies for its reduction.

Self-Study Component (SSC): Components of the environment.

Textbook 1: CH- 3

03 Hours

Module – II

Natural Resources Management and Energy

Natural Resources:

Water resources: availability, quality concerns, and associated health issues such as waterborne diseases and fluoride contamination in drinking water. Overview of natural resources and the challenges associated with their management. Population dynamics, including birth rate, death rate, immigration, and emigration and their impact on resource consumption.

Energy:

Types of energy sources: conventional and non-conventional. Focus on renewable energy sources such as solar energy, wind energy, and hydrogen as an alternative energy source.

Self-Study Component (SSC): Alternative Energy sources
Textbook 1: CH- 2

04 Hours

Module – III

Environmental Pollution, Legislation, and Policy

Pollution:

Water, air, soil, and noise pollution — their sources, impacts, preventive measures, and public health implications. Hazards of plastic usage and its impact on ecosystems and human health. Contemporary environmental issues including ozone layer depletion, and acid rain.

Environmental Legislation:

Overview of the Forest Conservation Act and challenges in the enforcement of environmental laws.

Environmental Law and Policy:

Critical evaluation of key environmental acts and policies. Introduction to environmental ethics, the concept of sustainability, and Environmental Impact Assessment (EIA). Role of non-governmental organizations (NGOs) in promoting public awareness and participation in environmental protection.

Self-Study Component (SSC): Case studies of air pollution episodes
Textbook 1: CH- 5

04 Hours

Module – IV

Waste Management:

Solid Waste Management: Types and sources; functional elements of SWM.

Biomedical Waste Management: Sources and characteristics; biodegradable medical products. AI-powered waste sorting, global perspectives, and future challenges.

Environmental Legislation:

Solid Waste Management Rules, 2016; Biomedical Waste Management Rules, 2016.

Self-Study Component (SSC): Case studies on waste management options.
Textbook 1: CH- 6.

03 Hours

Module – V

E-Waste Management

E-Waste:

Composition and generation of e-waste. Global context of e-waste. E-waste pollutants and hazardous properties. Effects of e-waste pollutants on human health and the surrounding environment. Domestic e-waste disposal. Basic principles of e-waste management. Components of e-waste management. Sustainable product design and development. E-waste recycling.

Legislation:

E-Waste (Management and Handling) Rules, 2011, and E-Waste (Management) Rules, 2022 – salient features and their implications.

Self-Study Component (SSC): E-Waste (Management) Amendment Rules, 2023,
2024 Textbook 1: e-resource:2

04 Hours

Teaching-Learning Process for all modules

Chalk and board, Active Learning, PPT
Based presentation, Videos

Course Outcomes:

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

1. Understand the principles of ecology and the environmental issues related to air, land, and water on a global scale
2. Develop observation skills to address environmental problems effectively.
3. Apply the basic principles of e-waste management, including collection, recycling, and safe disposal method
4. Able to identify the hazardous effect of e waste and focus on current role.
5. To follow the guidelines of environment and e-waste and conduct survey to acquire the knowledge about biomedical waste disposal.

Assessment Details (Both CIE and SEE)

	Component	Weightage (%)	
Internal Assessment Tests (IAT)	IAT 1	25	25
	IAT 2	25	
Comprehensive continuous evaluation (CCE)	CCE1	25	25
	CCE-2	25	
Continuous Internal Evaluation Total Marks: 100. Reduced to 50 Marks			
Semester End Examination (SEE) Total Marks: 100. Reduced to 50 Marks			

Suggested Learning Resources:

Textbooks

S M Prakash , “Environmental Studies” 3rd Edition, Elite Publishing House, Mangalore, 2018.

Hester R.E., and Harrison R.M, Electronic Waste Management. Science, 2009.

Reference Books:

Benny Joseph (2005), “Environmental Studies” , Tata McGraw – Hill Publishing Company Limited.

R. Rajagopalan, “Environmental Studies- From Crisis to Cure”, 2nd Edition, Oxford university press, New Delhi, 2013.

G. Tyler Miller Jr., Scott Spoolman “Introduction to Environmental Science – , Cengage Learning

Web links and Video Lectures (e-Resources):

<https://sdgs.un.org/goals>

<https://kspcb.karnataka.gov.in/waste-management/biomedical-waste>

E Waste (Management) Rules, 2022: <https://kspcb.karnataka.gov.in/sites/default/files/inline-files/E%20Waste%20%28Management%29%20Rules%2C%202022.pdf>

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Analysis report of case study specified in the Textbooks and reference books (one per student). (10 marks)
- Field Survey (In Team): The students' team of the size of 2 to 4 are expected to visit the organization or Industry understand the waste management, utilization of energy, pollution concerns, e-waste handling and other related suggested best practices specified in the syllabus and then submit a detailed visit report to the concerned staff. (15 marks)

CO-PO MAPPING:

POS Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C308.1	2	-	-	-	-	1	3	-	-	-	-	2
C308.2	-	1	2	-	-	-	2	-	3	-	-	2
C308.3	-	-	-	-	-	1	2	2	2	1	-	2
C308.4	-	-	-	-	-	1	1	-	-	-	-	2
C308.5	-	-	-	-	-	1	3	-	-	1	-	2