M.Tech. ECE- 3rd Semester

Category	Course Code	Course Title	Subject Type	Hours per week			Maximum Marks			Credits
				L	T	P	Int.	Ext.	Total	
Professional Elective	25C1ECP-PE5-XX	01 - Elective – V 02 - Pattern Recognition and Machine learning Remote Sensing	T	3	0	0	40	60	100	3
Open Elective	25C1ECP-OE1-XX	01 - Cost Management of Engineering Projects 02 - Waste to Energy	T	3	0	0	40	60	100	3
Dissertation	25C1ECP-DS1	Dissertation Phase –I	P	0	0	20	60	40	100	10
Total				**6**	**0**	**20**	**140**	**160**	**300**	**16**

M.Tech. ECE- 4th Semester

Category	Code	Course Title	Subject Type	Hours per week			Marks Distribution			Credits
				L	T	P	Int	Ext	Total	
Thesis	25C1ECP-DS2	Dissertation-II	P	0	0	32	60	40	100	16
Total				**0**	**0**	**32**	**60**	**40**	**100**	**16**

Course Code	Course Title	Category	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1ECP-PE5-01	Pattern Recognition and Machine Learning	PEC	3	3	0	0	40	60	100

Pre-requisite: Engineering Graduate with ECE/EEE/EE/EI

Course Outcomes

At the end of the course; the student will be able to	
CO1	Analyze pattern recognition concepts, probability models, and Bayesian decision theory.
CO2	Apply the concept of linear regression and logistic regression models for classification tasks.
CO3	Apply neural networks and Support Vector Machines for classification problems.
CO4	Evaluate classifier performance using bias-variance and ensemble techniques.
CO5	Apply different clustering techniques for unsupervised learning.

Detailed Syllabus

Unit 1: Introduction to Pattern Recognition: Problems, applications, design cycle, learning and adaptation, examples, Probability Distributions, Parametric Learning - Maximum likelihood and Bayesian Decision Theory- Bayes rule, discriminant functions, loss functions and Bayesian error analysis. **(6 Hrs.)**

Unit 2: Linear models: Linear Models for Regression, linear regression, logistic regression Linear Models for Classification. **(8 Hrs.)**

Unit 3: Neural Network: perceptron, multi-layer perceptron, back propagation algorithm, error surfaces, practical techniques for improving back propagation, additional networks and training methods, Adaboost, Deep Learning. **(8 Hrs.)**

Unit 4: Linear discriminant functions -decision surfaces, two-category, multi-category, minimum squared error procedures, the Ho-Kashyap procedures, linear programming algorithms, Support vector machine. **(7 Hrs.)**

Unit 5: Algorithm independent machine learning – lack of inherent superiority of any classifier, bias and variance, re-sampling for classifier design, combining classifiers. **(7 Hrs.)**

Unit 6: Unsupervised learning and clustering – k-means clustering, fuzzy k-means clustering, hierarchical clustering. **(7 Hrs.)**

Text Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Pattern Classification	Richard O. Duda, Peter E. Hart, David G. Stork,	John Wiley & Sons	2nd (2001)
2	Pattern Recognition and Machine Learning	C. Bishop	Springer	2nd (2006)

Reference Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1.	The Elements of Statistical Learning	Trevor Hastie, Robert Tibshirani, Jerome H. Friedman	Springer	2nd (2009)

Course Code	Course Title	Category	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1ECP-PE5-02	Remote Sensing	PEC	3	3	0	0	40	60	100

Pre-requisite: Engineering Graduate with ECE/EEE/EE/EI

Course Outcomes

At the end of the course; the student will be able to	
CO1	Interpret the physics of remote sensing including electromagnetic spectrum, atmospheric effects, and spectral reflectance characteristics of natural features.
CO2	Describe different remote sensing platforms and satellite systems along with characteristics in data acquisition.
CO3	Analyze the working principles and characteristics of photographic products, electro-optical sensors, multispectral scanners, and thermal scanners.
CO4	Examine various microwave remote sensing techniques along with their classification methods, and LiDAR-based terrain mapping.
CO5	Evaluate remote sensing data using image processing techniques such as aerial laser terrain mapping.

Detailed Syllabus

Unit 1: Physics Of Remote Sensing: Electro Magnetic Spectrum, Physics of Remote Sensing Effects of Atmosphere Scattering–Different types–Absorption-Atmospheric window-Energy interaction with surface features –Spectral reflectance of vegetation, soil and water atmospheric influence on spectral response patterns-multi concept in Remote sensing. **(8 Hrs.)**

Unit 2: Data Acquisition: Types of Platforms–different types of aircrafts-Manned and Unmanned spacecrafts–sun synchronous and geo synchronous satellites –Types and characteristics of different platforms –LANDSAT, SPOT, IRS, INSAT, IKONOS, QUICKBIRD ETC. **(8 Hrs.)**

Unit 3: Photographic products : B/W, color, color IR film and their characteristics –resolving power of lens and film - Opto mechanical electro optical sensors –across track and along track scanners-multispectral scanners and thermal scanners–geometric characteristics of scanner imagery -calibration of thermal scanners. **(8 Hrs.)**

Unit 4: Scattering System: Microwave scatterometry, types of RADAR –SLAR –resolution – range and azimuth –real aperture and synthetic aperture RADAR. Characteristics of Microwave images topographic effect-different types of Remote Sensing platforms –airborne and space borne sensors -ERS, JERS, RADARSAT, RISAT -Scatterometer, Altimeter-LiDAR remote sensing, principles, applications. **(7 Hrs.)**

Unit 5: Thermal And Hyper Spectral Remote Sensing**:** Sensors characteristics-principle of spectroscopy-imaging spectroscopy–field conditions, compound spectral curve, Spectral library,

radiative models, processing procedures, derivative spectrometry, thermal remote sensing – thermal sensors, principles, thermal data processing, applications. **(7 Hrs.)**

Unit 6: Data Analysis: Resolution–Spatial, Spectral, Radiometric and temporal resolution-signal to noise ratio-data products and their characteristics-visual and digital interpretation–Basic principles of data processing –Radiometric correction–Image enhancement–Image classification–Principles of LiDAR, Aerial Laser Terrain Mapping. **(7 Hrs.)**

Text Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Remote Sensing and Image interpretation	Lillesand T.M., and Kiefer, R.W.	John Wiley & Sons	6th (2000)
2	Introductory Digital Image Processing: A Remote Sensing Perspective	John R. Jensen	Pearson	2nd (1995)
3	Remote Sensing Digital Image Analysis	John A.Richards, Springer – Verlag,	Wiley	6th (2022)

Reference Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Principles of Remote Sensing	Paul Curran P.J.	ELBS	(1995)
2	Introduction To The Physics and Techniques of Remote Sensing	Charles Elachi and Jakob J. van Zyl	Wiley Series	3rd (2021)

Course Code	Course Title	Category	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1ECP-OE1-XX	Waste to Energy	OEC	3	3	0	0	40	60	100

Pre-requisite: Engineering Graduate

Course Outcomes

At the end of the course; the student will be able to	
CO1	Explain the concept of waste-to-energy, waste classification and basic conversion devices.
CO2	Describe biomass pyrolysis processes, types and products.
CO3	Apply biomass gasification principles in gasifier systems.
CO4	Analyze the operation of biomass combustion systems.
CO5	Evaluate bioenergy systems including biogas and biomass conversion technologies.

Detailed Syllabus

Unit 1: Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors. **(9 Hrs.)**

Unit 2: Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications. **(9 Hrs.)**

Unit 3: Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation. **(9 Hrs.)**

Unit 4: Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors. **(9 Hrs.)**

Unit 5: Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India. **(9 Hrs.)**

Text Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Non-Conventional Energy	Ashok V. Desai	New Age International Private Limited	2nd (2022)
2	Biomass Conversion and Technology	C. Y. WereKo-Brobby & E. B. Hagan	Wiley–Blackwell	1st (1996)

Reference Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Biogas Technology – A Practical Handbook (Vol. I & II)	K. C. Khandelwal & S. S. Mahdi	Tata McGraw Hill Publishing Co. Ltd.	1st (2008)
2	Energy from Waste: An Evaluation of Conversion Technologies	C. Parker & T. Roberts (Eds.)	Elsevier Applied Science, London	1st (1985)

Course Code	Course Title	Category	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1ECP-OE1-XX	Cost Management of Engineering Projects	OEC	3	3	0	0	40	60	100

Pre-requisite: Engineering Graduate

Course Outcomes

At the end of the course; the student will be able to	
CO1	Explain the concept of Strategic Cost Management Process in managerial decision-making.
CO2	Apply project management concepts to illustrate project attributes, project life cycle, and the project management process involved in project execution.
CO3	Analyze the differences between marginal costing and absorption costing and evaluate their role in break-even and cost–volume–profit analysis for managerial decision-making.
CO4	Analyze different mathematical functions using Laplace transform.
CO5	Evaluate project scheduling and monitoring techniques using Line of Balance (LOB) and network-based methods such as PERT and CPM.

Detailed Syllabus

Unit 1: Introduction and Overview of the Strategic Cost Management Process: Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making. **(6 Hrs.)**

Unit 2: Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process. **(6 Hrs.)**

Unit 3: Cost Behavior and Profit Planning Marginal Costing: Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just- in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-

based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing. **(8 Hrs.)**

Unit 4: Quantitative techniques for cost management**:** Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory. **(9 Hrs.)**

Text Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Cost Accounting A Managerial Emphasis	Ashok V. Desai	Prentice Hall of India, New Delhi	2nd (2022)
2	Advanced Management Accounting	Charles T. Horngren and George Foster	Wiley–Blackwell	1st (1996)

Reference Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Management & Cost Accounting	Robert S Kaplan Anthony A. Atkinson	Tata McGraw Hill Publishing Co. Ltd.	1st (1996)
3	Quantitative Techniques in Management	N.D. Vohra	Tata McGraw Hill Book Co. Ltd.	1st (1987)