

## M.Tech. CSE- 3rd Semester

Category	Code	Course Title	Subject Type	Hours per week			Marks Distribution			Credits
				L	T	P	Int	Ext	Total	
Professional Elective	25C1CSP-PE5-01/02/03	Optimization Techniques/Mobile Applications and Services/Compiler for HPC	T	3	0	0	40	60	100	3
Open Elective	25C1CSP-OE-01/02/03/04/05/06	Operation Research / Business Analytics/ Industrial Safety/ Cost Management of Engineering Projects/ Composite Materials/ Waste to Energy	T	3	0	0	40	60	100	3
Dissertation -I	25C1CSP-311	Dissertation-I	P	0	0	20	60	40	100	7
Training	25C1CSP-312	Industry/Institution al	P	0	0	0	60	40	100	3
<b>Total</b>				<b>6</b>	<b>0</b>	<b>20</b>	<b>200</b>	<b>200</b>	<b>400</b>	<b>16</b>

## M.Tech. CSE- 4th Semester

Category	Code	Course Title	Subject Type	Hours per week			Marks Distribution			Credits
				L	T	P	Int	Ext	Total	
Thesis	25C1CSP-411	Dissertation-II	P	0	0	32	60	40	100	16
<b>Total</b>				<b>0</b>	<b>0</b>	<b>0</b>	<b>60</b>	<b>40</b>	<b>100</b>	<b>16</b>

***M.Tech. CSE***  
***3<sup>rd</sup> Semester***  
***Syllabus***

Course Code	Course Name	Course Type	C d	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1CSP-PE5-01	Optimization Techniques	PCC	3	3	0	0	40	60	100

### Course Outcomes

At the end of the course, the student will be able to:	
CO1	Identify real-world engineering problems and formulate them as mathematical optimization models.
CO2	Apply appropriate optimality criteria to solve unconstrained and constrained optimization problems.
CO3	Analyze different mathematical programming techniques to address NP-hard and combinatorial optimization problems.
CO4	Evaluate the efficiency and applicability of various classical and modern optimization algorithms.
CO5	Propose optimization-based solutions for real-life problems using recent trends and tools in the field.

### Detailed Syllabus

**UNIT 1:** Engineering application of Optimization, Formulation of design problems as mathematical programming problems. **(8 Hrs.)**

**UNIT 2:** General Structure of Optimization Algorithms, Constraints, The Feasible Region. **(8 Hrs.)**

**UNIT 3:** Branches of Mathematical Programming: Optimization using calculus, Graphical Optimization, Linear Programming, Quadratic Programming, Integer Programming, Semi Definite Programming **(12Hrs.)**

**UNIT 4:** Optimization Algorithms like Genetic Optimization, Particle Swarm Optimization, Ant Colony Optimization etc. **(13 Hrs.)**

**UNIT 5:** Real life Problems and their mathematical formulation as standard programming problems. **(7 Hrs.)**

### Recent Trends

Applications of ant colony optimization, genetics and linear and quadratic programming in real world applications

### Text Books

S. No	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Practical Optimization: Algorithms and Engineering Applications	Andreas Antoniou, Wu-Sheng Lu	Springer-Verlag New York Inc.	2007
2	An Introduction to Optimization	Edwin K. P. Chong, Stanislaw H. Zak	Wiley-Blackwell	3 <sup>rd</sup> (2008)

### Reference Books

S. No	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Logic and Integer Programming	Springer	Springer	1 <sup>st</sup> (2009)
2	Optimization Techniques	A. K. Malik, S. K. Yadav, S. R. Yadav	I K International Publishing House Pvt. Ltd	2013
3	Applied Integer Programming: Modeling and Solution	Der-San Chen, Robert G. Batson, Yu Dang	Wiley	1 <sup>st</sup> (2011)

Course Code	Course Name	Course Type	C d	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1CSP-PE5-02	Mobile Applications and Services	PEC	3	3	0	0	40	60	100

### Course Outcomes

At the end of the course, the student will be able to:	
CO1	Explain fundamentals of mobile computing and android development environment.
CO2	Identify mobile user interfaces and data management in Android applications.
CO3	Analyze networking, telephony, and performance aspects of mobile applications.
CO4	Develop mobile applications integrating location-based services, graphics, and multimedia.
CO5	Evaluate mobile application security, testing methods, and emerging mobile computing trends including IoT.

### Detailed Syllabus

**UNIT 1:** Introduction to Mobile Computing, Introduction to Android Development Environment, Factors in Developing Mobile Applications, Mobile Software Engineering, Frameworks and Tools, Generic UI Development Android User. **(9 Hrs.)**

**UNIT 2:** More on Uis: VUIs and Mobile Apps, Text-to-Speech Techniques, Designing the Right UI, Multichannel and Multimodal Uis, Storing and Retrieving Data, Synchronization and Replication of Mobile Data, Getting the Model Right, Android Storing and Retrieving Data, Working with a Content Provider. **(9 Hrs.)**

**UNIT 3:** Communications via Network and the Web: State Machine, Correct Communications Model, Android Networking and Web, Telephony Deciding Scope of an App, Wireless Connectivity and Mobile Apps, Android Telephony. Notifications and Alarms: Performance, Performance and Memory Management, Android Notifications and Alarms, Graphics, Performance and Multithreading, Graphics and UI Performance, Android Graphics. **(11 Hrs.)**

**UNIT 4:** Putting It All Together: Packaging and Deploying, Performance Best Practices, Android Field Service App, Location Mobility and Location Based Services Android. Multimedia: Mobile Agents and Peer-to-Peer Architecture, Android Multimedia. **(10 Hrs.)**

**UNIT 5:** Platforms and Additional Issues: Development Process, Architecture, Design, Technology Selection, Mobile App Development Hurdles, Testing, Security and Hacking, Active Transactions, More on Security, Hacking Android. **(9 Hrs.)**

#### Recent Trends:

Recent trends in Communication protocols for IOT nodes, mobile computing techniques in IOT, agents-based communications in IOT.

### Text Books

S. No	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Beginning Android™ 4 Application Development	Wei-Meng Lee	John Wiley & Sons	2012

Course Code	Course Name	Course Type	C d	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1CSP-PE5-03	Compiler for HPC	PEC	3	3	0	0	40	60	100

### Course Outcomes

At the end of the course, the student will be able to:	
CO1	Explain the architecture of compilers and programming language features used in high-performance computing systems.
CO2	Analyze data dependencies in programs using techniques such as dependence graphs and use-def chains.
CO3	Apply loop and array transformation techniques to optimize program locality and performance.
CO4	Evaluate concurrency and vectorization strategies for efficient parallel program execution.
CO5	Design optimized parallel code for message-passing and shared-memory architectures in HPC environments.

### Detailed Syllabus

**UNIT 1:** High Performance Systems, Structure of a Compiler, Programming Language Features, Languages for High Performance. **(8 Hrs.)**

**UNIT 2:** Data Dependence: Data Dependence in Loops, Data Dependence in Conditionals, Data Dependence in Parallel Loops, Program Dependence Graph. Scalar Analysis with Factored Use-Def Chains: Constructing Factored Use-Def Chains, FUD Chains for Arrays, Induction Variables Using FUD Chains, Constant Propagation with FUD Chains, Data Dependence for Scalars. Data Dependence Analysis for Arrays. **(8 Hrs.)**

**UNIT 3:** Array Region Analysis, Pointer Analysis, I/O Dependence, Procedure Calls, Inter-procedural Analysis. Loop Restructuring: Simple Transformations, Loop Fusion, Loop Fission, Loop Reversal, Loop Interchanging, Loop Skewing, Linear Loop Transformations, Strip-Mining, Loop Tiling, Other Loop Transformations, and Inter-procedural Transformations. Optimizing for Locality: Single Reference to Each Array, Multiple References, General Tiling, Fission and Fusion for Locality. **(11 Hrs.)**

**UNIT 4:** Concurrency Analysis: Concurrency from Sequential Loops, Concurrency from Parallel Loops, Nested Loops, Round off Error, Exceptions and Debuggers. Vector Analysis: Vector Code, Vector Code from Sequential Loops, Vector Code from For all Loops, Nested Loops, Round off Error, Exceptions, and Debuggers, Multi-vector Computers. **(11 Hrs.)**

**UNIT 5:** Message-Passing Machines: SIMD Machines, MIMD Machines, Data Layout, Parallel Code for Array Assignment, Remote Data Access, Automatic Data Layout, Multiple Array Assignments, Other Topics. Scalable Shared-Memory Machines: Global Cache Coherence, Local Cache Coherence, Latency Tolerant Machines. **(10 Hrs.)**

### Recent Trends:

Recent trends in compiler design for high performance computing and message passing machines and scalable shared memory machine.

### Text Books

S. No	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	High-Performance Compilers for Parallel Computing	Michael Wolfe	Pearson	1995

Course Code	Course Name	Course Type	C d	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1CSP- OE-01	Operations Research	OEC	3	3	0	0	40	60	100

### Course Outcomes

At the end of the course, the student will be able to:	
CO1	Apply model formulation techniques and perform sensitivity analysis for decision-making models.
CO2	Solve linear programming problems using appropriate optimization techniques.
CO3	Evaluate optimal solutions for non-linear programming problems using suitable algorithms
CO4	Analyze scheduling and sequencing models for solving real-life optimization problems
CO5	Design dynamic programming models to address optimization problems involving discrete and continuous variables.

### Detailed Syllabus

**UNIT 1:** Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models. **(8 Hrs.)**

**UNIT 2:** Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method- sensitivity analysis - parametric programming. **(8 Hrs.)**

**UNIT 3:** Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem- CPM/PERT. **(7 Hrs.)**

**UNIT 4:** Scheduling and sequencing - single server and multiple server models – deterministic inventory models - Probabilistic inventory control models - Geometric Programming. **(7 Hrs.)**

**UNIT 5:** Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flowing Networks, Elementary Graph Theory, Game Theory Simulation **(6 Hrs.)**

### Text Books

S. No	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Operations Research An Introduction	H.A. Taha	PHI	2008
2	Principles of Operations Research	H.M. Wagner	PHI	1982
3	Introduction to Optimisation: Operations Research	J.C. Pant	Jain Brothers, Delhi	2008

### Reference Books

S. No	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Operations Research	Hitler Libermann	McGraw Hill Pub	2009
2	Operations Research	Pannerselvam	Prentice Hall of India	2010

Course Code	Course Name	Course Type	C d	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1CSP- OE-02	Business Analytics	OEC	3	3	0	0	40	60	100

### Course Outcomes

At the end of the course, the student will be able to:	
CO1	Explain the concepts, processes, and scope of business analytics and statistical tools used for data analysis.
CO2	Apply statistical and regression techniques to analyze trends and relationships in business data.
CO3	Analyze business data using descriptive, predictive, and prescriptive analytics techniques.
CO4	Predict forecasting models, simulation methods, and decision analysis techniques for business decision-making.
CO5	Develop data-driven insights and recommendations using modern business analytics tools and techniques.

### Detailed Syllabus

**UNIT 1:** Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview. **(10 Hrs.)**

**UNIT 2:** Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology. **(9 Hrs.)**

**UNIT 3:** Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization. **(10 Hrs.)**

**UNIT 4:** Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carlo Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model. **(11 Hrs.)**

**UNIT 5:** Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making. **(8 Hrs.)**

### Recent Trends:

Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

### Text Books

S. No	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Business analytics Principles, Concepts, and Applications	Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey	Pearson FT Press	2014
2	Business Analytics	James Evans	Pearsons Education	2020

Course Code	Course Name	Course Type	C d	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1CSP-OE-03	Industrial Safety	OEC	3	3	0	0	40	60	100

### Course Outcomes

At the end of the course, the student will be able to:	
CO1	Explain the concepts of industrial safety, types of hazards, and accident prevention methods.
CO2	Identify mechanical and electrical hazards and apply appropriate fire prevention and firefighting techniques in industrial environments.
CO3	Analyze wear, corrosion, and lubrication methods for improving the reliability and safety of industrial machinery.
CO4	Apply decision tree techniques to diagnose and trace faults in industrial equipment and machine tools.
CO5	Evaluate periodic and preventive maintenance strategies to ensure safe and efficient operation of mechanical and electrical systems.

### Detailed Syllabus

**UNIT 1:** Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, washrooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc., Safety colour codes. Fire prevention and firefighting, equipment and methods. **(8 Hrs.)**

**UNIT 2:** Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, washrooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc., Safety color codes. Fire prevention and firefighting, equipment and methods. **(7 Hrs.)**

**UNIT 3:** Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods. **(8 Hrs.)**

**UNIT 4:** Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault-finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, AI. Pump, BI. Air compressor, IV. Internal combustion engine, V. Boiler, VI. Electrical motors, Types of faults in machine tools and their general causes. **(8 Hrs.)**

**UNIT 5:** Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance. **(8 Hrs.)**

### Text Books

S. No	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Maintenance Engineering Handbook	Higgins & Morrow	Da Information Services	1987
2	Pump-hydraulic Compressors	Audels	McGraw Hill Publication	6 <sup>th</sup> (2004)

Course Code	Course Name	Course Type	C d	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1CSP-OE-04	Cost Management of Engineering Projects	OEC	3	3	0	0	40	60	100

### Course Outcomes

At the end of the course, the student will be able to:	
CO1	Explain fundamental cost concepts and the role of costing systems in inventory valuation and managerial decision-making.
CO2	Apply project management tools such as bar charts and network diagrams for planning and controlling engineering project costs and schedules.
CO3	Analyze cost–volume–profit relationships and apply costing techniques such as marginal costing and break-even analysis for profit planning.
CO4	Evaluate modern cost management approaches including activity-based costing, budgeting methods, and performance measurement techniques.
CO5	Apply quantitative techniques such as PERT, CPM, linear programming, and simulation for effective cost management in engineering projects.

### 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 non- technical 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. **(8 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. **(8 Hrs.)**

**UNIT 4:** 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. **(6 Hrs.)**

**UNIT 5:** Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory. **(4 Hrs.)**

### Text Books

S. No	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Hornngren's Cost Accounting A Managerial Emphasis	Srikant Datar, Madhav Rajan	Pearson	16 <sup>th</sup> (2017)
2	Introduction to Management Accounting	Charles T. Horngren	Pearson	2012
3	Quantitative Techniques in Management	N.D. Vohra	Tata McGraw Hill Book	6 <sup>th</sup> (2021)

Course Code	Course Name	Course Type	C d	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1CSP- OE-05	Composite Materials	OEC	3	3	0	0	40	60	100

### Course Outcomes

At the end of the course, the student will be able to:	
CO1	Identify the classification, properties, and applications of composite materials and the role of reinforcement and matrix in composite performance.
CO2	Apply mechanical models such as rule of mixtures to evaluate the behavior of reinforced composites.
CO3	Analyze the properties and applications of different reinforcement materials.
CO4	Select appropriate manufacturing techniques for metal, ceramic, and polymer matrix composites.
CO5	Analyze strength and failure of composite laminates using suitable failure criteria for composite design.

### Detailed Syllabus

**UNIT 1:** Introduction: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance. **(6 Hrs.)**

**UNIT 2:** Reinforcements: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Is strain and Is stress conditions. **(7 Hrs.)**

**UNIT 3:** Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding–Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications. **(8 Hrs.)**

**UNIT 4:** Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and pre-pregs–hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications. **(4 Hrs.)**

**UNIT 5:** Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first ply failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations. **(5 Hrs.)**

### Text Books

S. No	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Material Science and Technology	R.W.Cahn	Wiley VCH	13 (1993)
2	Callister's Materials Science and Engineering	R. Balasubramaniam	Wiley	2 <sup>nd</sup> (2014)

Course Code	Course Name	Course Type	C d	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1CSP-OE-06	Waste to Energy	OEC	3	3	0	0	40	60	100

### Course Outcomes

At the end of the course, the student will be able to:	
CO1	Explain the classification of waste as fuel and the basic principles of waste-to-energy conversion systems.
CO2	Apply principles of biomass Pyrolysis and Gasification for energy generation from biomass resources.
CO3	Analyze the design and operation of biomass combustion systems for thermal and power generation applications.
CO4	Evaluate the performance and applications of Biogas and other bioenergy systems for sustainable energy production.
CO5	Assess waste-to-energy technologies for converting biomass and urban waste into useful fuels and power.

### 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. **(5 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. **(5 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. **(7 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. **(6 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. **(8 Hrs.)**

### Text Books

S. No	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Non-Conventional Energy	Desai, Ashok V.	Wiley Eastern Ltd.	1990
2	Biogas Technology - A Practical Hand Book	Khandelwal, K. C. and Mahdi, S. S.	Tata McGraw Hill	1983
3	Biomass Conversion and Technology	C. Y. WereKo-Brobby, E. B. Hagan	John Wiley & Sons	1996

Course Code	Course Name	Course Type	C d	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1CSP – 311	Dissertation-I	Dissertation	7	0	0	20	60	40	100

### Course Outcomes

At the end of the course, the student will be able to:	
CO1	Explain fundamental concepts and recent research trends in the selected area of computing.
CO2	Identify a relevant research problem based on research gaps and formulate clear objectives in the chosen domain of computing.
CO3	Analyze the identified problem and propose feasible technical solutions based on existing literature and tools.
CO4	Apply emerging technologies such as Blockchain, IoT, Robotics, ML, AI, Data Mining, and Big Data Analytics to solve problems.
CO5	Propose the dissertation work effectively through written reports, presentations, and documentation at various stages.

Course Code	Course Name	Course Type	C d	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1CSP – 312	Industry/Institutional Training	Training	0	0	0	3	60	40	100

### Course Outcomes

At the end of the course, the student will be able to:	
CO1	Explain fundamental concepts and recent research trends in the selected area of computing.
CO2	Identify a relevant research problem and formulate clear objectives in the chosen domain of computing.
CO3	Analyze the identified problem and propose feasible technical solutions based on existing literature and tools.
CO4	Apply emerging technologies such as Blockchain, IoT, Robotics, ML, AI, Data Mining, and Big Data Analytics to solve problems.
CO5	Propose the project work effectively through written reports, presentations, and documentation at various stages.

***M.Tech. CSE***  
***4<sup>th</sup> Semester***  
***Syllabus***

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1CSP – 411	Dissertation-II	Thesis	16	0	0	32	60	40	100

### Course Outcomes

At the end of the course, the student will be able to:	
CO1	Identify a computational problem relevant to the chosen domain of computing.
CO2	Evaluate existing approaches and analyze proposed solutions to the identified problem.
CO3	Design and implement effective computational solutions and analyze their performance and results.
CO4	Demonstrate ethical practices and continuous learning while conducting research in computing domains.
CO5	Develop a comprehensive thesis through structured documentation and oral defense.