ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2019-20)
MECHANICAL ENGINEERING (ME)
III B. Tech – II Semester

S. No	Category	Course Code	Course Title	Contact Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		CIE	SEE	Total
THEORY										
1	PC	19APC0316	Design of Machine Members – 2	3	1	0	4	30	70	100
2	PC	19APC0317	Heat Transfer	3	0	0	3	30	70	100
3	PC	19APC0319	Thermal Engineering – II	3	0	0	3	30	70	100
4	PE		**Professional Elective II**	3	0	0	3	30	70	100
		19APE0316	Management Science							
		19APE0317	Optimization Techniques							
		19APE0318	Introduction to CAD/CAM							
5	OE		**Open Elective II (Inter disciplinary)**	3	0	0	3	30	70	100
		19APC0513	Machine Learning							
		19APC0216	Neural Networks & Fuzzy Logics							
		19AOE0101	Structural Health Monitoring							
6	HE		**Humanities Elective I**	3	0	0	3	30	70	100
		19AHE9902	Principles of Effective Public Speaking							
		19AHE9904	Advanced Numerical Methods							
		19AHE9908	Electromagnetic Theory							
7	MC	19AMC9904	Professional Ethics and Human Values	2	0	0	0	30	-	30
PRACTICAL										
8	PR	19APR0303	Socially Relevant Projects (15 Hrs / Sem)	0	0	0	0.5	50	-	50
9	PC	19APC0318	Heat Transfer Lab	0	0	2	1	30	70	100
10	PC	19APC0320	Design & Simulation Lab	0	0	2	1	30	70	100
11	PR	19APR0304	Industrial Training/ Internship/ Research Projects in National Laboratories/Academic Institutions	0	0	0	0	-	-	-
			Total	**18**	**0**	**6**	**21.5**	**320**	**560**	**880**

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
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MECHANICAL ENGINEERING (ME)

Year: III **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0316	Design of Machine Members – II	3	1	0	4

Course Outcomes:

CO: 1 To design crane hooks, C-clamps and various belt, rope and chain drives
CO: 2 Design helical sprigs for two-wheel vehicle and laminated springs for trucks
CO: 3 Design journal bearings, ball bearings and roller bearings and to know the advantages of rolling contact bearings
CO: 4 Design spur and helical gears for different input conditions
CO: 5 Design engine components like Cylinder, piston, connecting rod and crankshaft

UNIT I

DESIGN OF CURVED BEAMS: Stresses in curved beams, Expression for radius of neutral axis for rectangular, circular, trapezoidal and T-Section. Design of crane hooks, C –clamps. DESIGN OF POWER TRANSMISSIONS SYSTEMS: Design of Flat belt drives, V-belt drives & rope drives. Selection of wire ropes, design procedure for chain drives.

UNIT II

DESIGN OF MECHANICAL SPRINGS: Stress and deflections of helical Springs-Springs for fatigue loading – Natural frequency of helical springs-Energy storage capacity- Helical Torsion springs- Design of leaf springs. DESIGN OF POWER SCREWS: Design of screw- Square, ACME and Buttress screws- Efficiency of the screw. Design of compound screw, differential screw, ball screw- possible failures

UNIT III

DESIGN OF BEARINGS: Types of Journal bearings – Lubrication – bearing materials – journal bearing design – Ball and roller bearings – Static loading of ball & roller bearings, bearing life –Failure of bearings

UNIT IV

DESIGN OF SPUR & HELICAL GEARS: Spur gears- Helical gears – Bending strength – Design analysis of spur and Helical gears – Estimation of centre distance, module and face width. Check for dynamic and wear considerations

UNIT V

DESIGN OF IC ENGINE PARTS: Pistons– Design of piston. Cylinder, Connecting Rod.

Text Books:

1. Mechanical Engineering Design, JosephE. Shigely, TMH Publishers, NewDelhi, 9th edition, 2010.
2. Machine Design, R.L. Norton, Tata McGraw Hill Publishers, 2nd edition, 2012.

Reference Books:

1. Machine Design, Schaum's series, TMH Publishers, New Delhi, 1st edition, 2011
2. Design ofMachine Elements, V.B. Bhandari, TMH Publishers, NewDelhi, 2nd edition, 2013.
3. Machine Design, Sadhu Singh, Khanna Publishers, NewDelhi
4. Design of Machine Elements, M.F. Spotts, PHI Publishers, NewDelhi.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2019-20)
MECHANICAL ENGINEERING (ME)

Year: III **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0317	Heat Transfer	3	0	0	3

Course Outcomes:

CO: 1 To understand the concept of modes of heat transfer and to solve problems on conduction heat transfer.
CO: 2 To understand heat transfer through extended surfaces and solve the problems in 1-D transient conduction heat transfer.
CO: 3 To understand concept of the convection heat transfer and to solve practical problems on forced and natural convection heat transfer.
CO: 4 Calculate heat transfer in boiling, condensation and understand principle behind heat exchangers and solve problems using LMTD and NTU methods.
CO: 5 Understand basic concepts of radiation heat transfer from black and gray bodies and solve problems involving radiation shields.

Unit I

Introduction: Modes and Mechanisms of Heat Transfer – Basic Laws of Heat Transfer – General Applications of Heat Transfer.
Conduction Heat Transfer: Fourier Rate Equation – General Heat Conduction Equation In Cartesian, Cylindrical and Spherical Coordinates. Simplification and Forms of the Field Equation – Steady, Unsteady and Periodic Heat Transfer – Boundary and Initial Conditions.
One Dimensional Steady State Heat Conduction: In Homogeneous Slabs, Hollow Cylinders and Spheres – Overall Heat Transfer Coefficient – Electrical Analogy –Thickness of Insulation / Critical Radius – With Variable Thermal Conductivity – With Internal Heat Sources or Heat Generation.

Unit II

Heat Transfer in Extended Surface (Fins) – Types, Fin Materials, Applications , efficiency, effectiveness and temperature distribution on Long Fin, Fin with Insulated Tip and Short Fin, Application to Errors in Temperature Measurement.
One Dimensional Transient Heat Conduction: In Systems with Negligible Internal Resistance – Significance of Biot and Fourier Numbers – Chart Solutions of Transient Conduction Systems – Problems on Semi-infinite Body.

Unit III

Heat Convective Transfer: Dimensional Analysis – Buckingham Π Theorem and its Application for Developing Semi – Empirical Non-Dimensional Correlations for Convective Heat Transfer – Significance of Non-Dimensional Numbers – Concepts of Continuity, Momentum and Energy Equations.
Forced Convection: External Flows: Concepts of Hydrodynamic and Thermal Boundary Layer and Use of Empirical Correlations for Convective Heat Transfer for Flow Over – Flat Plates, Cylinders and Spheres.
Internal Flows: Division of Internal Flow through Concepts of Hydrodynamic and Thermal Entry Lengths – Use of Empirical Relations for Convective Heat Transfer in Horizontal Pipe Flow.

Free Convection: Development of Hydrodynamic and Thermal Boundary Layer along a Vertical Plate – Use of Empirical Relations for Convective Heat Transfer on Plates and Cylinders in Horizontal and Vertical Orientation.

Unit IV

Heat Transfer with Phase Change:
Boiling: Pool Boiling – Regimes, Determination of Heat Transfer Coefficient in Nucleate Boiling, Critical Heat Flux and Film Boiling.
Condensation: Filmwise and Dropwise Condensation – Nusselt's Theory of Condensation on a Vertical Plate – Film Condensation on Vertical and Horizontal Cylinders Using Empirical Correlations.

Unit V

Radiative Heat Transfer: Emission Characteristics and Laws of Black-Body Radiation – Irradiation – Total and Monochromatic Quantities– Laws of Planck, Wien, Kirchoff, Lambert, Stefan And Boltzmann – Heat Exchange Between Two Black Bodies –Concepts of Shape Factor – Emissivity – Heat Exchange Between Gray Bodies – Radiation Shields – Electrical Analogy for Radiation Networks.

Text Books:

1. Heat and Mass Transfer, by Sachdeva, New age International.
2. Heat and Mass Transfer by Y.A Cengel, A J Ghajar, Mc Graw Hill education,2011.
3. Heat and Mass Transfer, R.K.Rajput, S.Chand& Company Ltd, 2001.

Reference Books:

1. Heat Transfer, P.K.Nag, 3/e, TMH, 2011.
2. Fundamentals of Heat and Mass Transfer, Kondandaraman, C.P., 3/e, New Age Publ.
3. Heat Transfer, Holman.J.P, 10/e, TMH, 2012.
4. Introduction to Heat Transfer, by lncropera and Dewitt, Wiley Publishers,2001.
5. Heat Transfer, M. Necati Ozisik, A Basic Approach, McGraw Hill, New York, 2005.

Note: - Heat and mass transfer data book by C.P. kothandaraman, New age publications is permitted for internal and external examinations.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2019-20)
MECHANICAL ENGINEERING (ME)

Year: III **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0319	Thermal Engineering – II	3	0	0	3

Course Outcomes:

CO: 1 To understand efficiency enhancement methods of Reheating and regeneration. Student can able to understand the key role of quality of steam after evaporation
CO: 2 To able to understand the working of different high pressure and low-pressure boilers.
CO: 3 To able to distinguish the ideal flow and actual flow through nozzle. Student can know the importance of maximum discharge through nozzle.
CO: 4 To construct the velocity triangle and combined velocity triangle and can learn its importance in determining the power produced by the turbine.
CO: 5 To participate in science exhibitions based on the concept of thermal power plants.

UNIT I

BASIC CONCEPTS: Rankine Cycle - Schematic Layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat Addition, Methods to Improve Cycle Performance – Regeneration – Reheating- Combined- Cycles.

UNIT II

BOILERS: Classification Based on Working Principles & Pressures of Operation - L.P & H.P. Boilers – Mountings and Accessories.

DRAUGHT: Classification – Height Of Chimney for Given Draught and Discharge, Condition for Maximum Discharge, Efficiency of Chimney – Artificial Draught, Induced and Forced Draught

UNIT III

STEAM NOZZLES: Function of Nozzle – Applications - Types, Flow through Nozzles, Thermodynamic Analysis – Assumptions -Velocity of Nozzle at Exit-Ideal and Actual Expansion in Nozzle, Velocity Coefficient, Condition for Maximum Discharge, Critical Pressure Ratio. Criteria for Design of Nozzle Shape: Super Saturated Flow and its Effects, Degree of Super Saturation and Degree of Under Cooling - Wilson Line –Shock at The Exit. CONDENSERS: Classification, Air Leakage Vacuum Efficiency, condenser efficiency, problems.

UNIT IV

IMPULSE TURBINE:

Mechanical Details – Velocity Diagram – Effect of Friction – Power Developed, Axial Thrust Blade or Diagram Efficiency – Condition for Maximum Efficiency. De-Laval Turbine - Its Features. Methods To Reduce Rotor Speed - Velocity Compounding and Pressure Compounding, Velocity and Pressure Variation Along the Flow – Combined Velocity Diagram for a Velocity Compounded Impulse Turbine.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2019-20)
MECHANICAL ENGINEERING (ME)

REACTION TURBINE: Mechanical Details – Principle of Operation, Thermodynamic Analysis of a Stage, Degree of Reaction –Velocity Diagram – Parson's Reaction Turbine – Condition for Maximum Efficiency.

UNIT V

JET PROPULSION: Principle of Operation – Classification of Jet Propulsive Engines – Working Principles with Schematic Diagrams and Representation on T-S Diagram - Thrust, Thrust Power and Propulsion Efficiency – Turbo Jet, Turbo Prop, Pulse Jet Engines – Schematic Diagram, Thermodynamic Cycle. Introduction to Rocket Propulsion

Text Books:

1. Thermal Engineering, R.K. Rajput, 9/e, Lakshmi Publications, 2013
2. Basic and Applied Thermodynamics, P.K. Nag, TMH, 2nd Edition,2012

Reference Books:

1. Gas Turbines, V. Ganesan, TMH
2. Thermodynamics and Heat Engines, R.Yadav, Central Publishing House, Allahabad, 2002.
3. Thermal Engineering, Mahesh M Rathore, McGrawHill,2010
4. Gas Turbines and Propulsive Systems, P.Khajuria&S.P.Dubey, Dhanpatrai
5. Thermal Engineering, R.S Khurmi & JS Gupta, S.Chand, 2012.
6. Thermal Engineering Data Book, B.S. Reddy and K.H. Reddy, I.K. International, 2007.
7. Steam Tables SI Units- Dr.B. Umamaheswar Gowd and A. Nagraju, Siri Publ.

NOTE: *Steam tables and Mollier charts to be supplied for exam*

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2019-20)
MECHANICAL ENGINEERING (ME)

Year: III **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APE0316	Management Science	3	0	0	3

Course Outcomes:

CO: 1 Understand the concepts & principles of management and designs of organization in a practical world.
CO: 2 Apply the knowledge of Work-study principles & Quality Control techniques in industry.
CO: 3 Analyze the concepts of HRM in Recruitment, Selection and Training & Development.
CO: 4 Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyze the business through SWOT.
CO: 5 Create Modern technology in management science

UNIT I

Introduction to Management:

Management - Concept - Nature - Functions – Levels - Evolution of Management Thought - Taylor's Scientific Theory - Henry Fayol's principles - Elton Mayo's Human relations - Leadership styles - Autocratic leadership - Democratic & Free rein leadership.
Organizational Designs: Line organization - Line & Staff Organization - Functional Organization - Matrix Organization - Project Organization - Committee form of Organization.

UNIT II

Operations Management:

Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), Work Study. **Material Management** - Objectives – Inventory classification - Inventory Techniques - EOQ-ABC Analysis

Marketing Management: Concept - Meaning - Nature- Functions of Marketing - Marketing Mix - Channels of Distribution - Advertisement and Sales Promotion - Marketing Strategies based on Product Life Cycle.

UNIT III

Human Resources Management (HRM):

HRM - Definition and Meaning - Managerial and Operative functions - Evolution of HRM - Job Analysis & Job Evaluation - Human Resource Planning (HRP) Process/Procedure- Employee Recruitment Process - Employee Selection Process and Tests in Employee Selection - Employee Training and Development - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration

UNIT IV

Strategic Management:

Definition & Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process - Environmental Scanning - SWOT Analysis

Project Management - Network Analysis - Programme Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems).

UNIT V

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
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MECHANICAL ENGINEERING (ME)

Contemporary Management:

The concept of Management Information System (MIS) - Materials Requirement Planning (MRP) - Customer Relations Management (CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management (SCM) - Enterprise Resource Planning (ERP) - Performance Management - Business Process Outsourcing (BPO) - Business Process Re-engineering and Bench Marking - Balanced Score Card.

Textbooks:

1. A.R Aryasri, "Management Science", TMH, 2013
2. Stoner, Freeman, Gilbert, Management, Pearson Education, New Delhi, 2012.

References:

1. Koontz & Weihrich, "Essentials of Management", 6th edition, TMH, 2005.
2. Thomas N.Duening & John M.Ivancevich, "Management Principles and Guidelines", Biztantra.
3. Kanishka Bedi, "Production and Operations Management", Oxford University Press, 2004.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2019-20)
MECHANICAL ENGINEERING (ME)

Year: III **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APE0317	Optimization Techniques	3	0	0	3

Course Outcomes:

CO: 1 Explain the need of optimization of engineering systems
CO: 2 Understand optimization of electrical and electronics engineering problems
CO: 3 Apply classical optimization techniques, linear programming, simplex algorithm, transportation problem
CO: 4 Apply unconstrained optimization and constrained non-linear programming and dynamic programming
CO: 5 Formulate optimization problems

UNIT I

Introduction and Classical Optimization Techniques: Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems.

Classical Optimization Techniques: Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers – Multivariable Optimization with inequality constraints – Kuhn – Tucker conditions.

UNIT – II:

Linear Programming: Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm.

Transportation Problem: Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems.

UNIT – III:

Unconstrained Nonlinear Programming: One dimensional minimization method, Classification, Fibonacci method and Quadratic interpolation method Unconstrained Optimization Techniques: Univariant method, Powell's method and steepest descent method.

UNIT – IV:

Constrained Nonlinear Programming: Characteristics of a constrained problem - classification - Basic approach of Penalty Function method - Basic approach of Penalty Function method - Basic approaches of Interior and Exterior penalty function methods - Introduction to convex programming problem.

UNIT – V:

Dynamic Programming: Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in

dynamic programming – examples illustrating the calculus method of solution - examples illustrating the tabular method of solution

TEXT BOOKS:

1. Singiresu S. Rao, Engineering Optimization: Theory and Practice by John Wiley and Sons, 4th edition, 2009.
2. H. S. Kasene & K. D. Kumar, Introductory Operations Research, Springer (India), Pvt. Ltd., 2004

REFERENCE BOOKS:

1. George Bernard Dantzig, Mukund Narain Thapa, "Linear programming", Springer series in operations research 3rd edition, 2003.
2. H.A. Taha, "Operations Research: An Introduction", 8th Edition, Pearson/Prentice Hall, 2007.
3. Kalyanmoy Deb, "Optimization for Engineering Design – Algorithms and Examples", PHI Learning Pvt. Ltd, New Delhi, 2005

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2019-20)
MECHANICAL ENGINEERING (ME)

Year: III **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APE0318	Intriduction to CAD/CAM	3	0	0	3

Course Outcomes:

CO: 1 Understand the basic concepts components of CAD/CAM. Concepts of Graphics techniques.
CO: 2 Understand the concepts of Geometric representation methods..
CO: 3 Understand and apply Numerical CNC Part Programming methods.
CO: 4 Understand the concepts of Group technology and techniques, production flow Analysis.
CO: 5 Understand the concepts of FMS and its elements.

UNIT I

Introduction: Definition and scope of CAD/CAM- Computers in industrial manufacturing, design process-Computer Aided Design (CAD)-Computer Aided Manufacturing (CAM)-Computer Integrated Manufacturing (CIM)

Graphics: Data base for graphic modeling-transformation geometry-3D transformations – Clipping-hidden line removal-Colour-shading

UNIT II

Geometric modelling

Parametric representation of curves, solids & surfaces. Geometric construction methods-Constraint based modeling- Wireframe, Surface- Bezier , B-Spline Surfaces and Solid-Constructive Solid Geometry,Boundary representation and Cellular Decomposition.

UNIT III

NC Control production systems:

Introduction to NC, CNC, DNC - Manual part Programming – Computer Assisted Part Programming – Examples using NC codes- Adaptive Control – Canned cycles and subroutines – CAD/ CAM approach to NC part programming – APT language

UNIT IV

Role of information systems in manufacturing

Discrete part manufacture-information requirements of a production organization-manufacturing strategies-Integration requirement - Group technology-coding-Production flow analysis-computer part programming-CAPP implementation techniques.

UNIT V

Automated manufacturing systems

Flexible Manufacturing systems (FMS) – the FMS concepts – transfer systems – head changing FMS – Introduction to Rapid prototyping, Knowledge Based Engineering, Virtual Reality, Augmented Reality –automated guided vehicle-Robots-automated storage and retrieval systems - computer aided quality control-CMM-Non contact inspection methods.

Textbooks:

1. P.N.Rao, CAD/CAM: Principles &Applications-3rd Edition, Tata McGraw Hill.
2. CAD/CAM Concepts & applications/Alavala/PHI

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2019-20)
MECHANICAL ENGINEERING (ME)

References:

1. CAD/CAM Theory and Practice / IbrahimZeid / TMH..
2. CAD/CAM/CIM Radha Krishnan & Subramanian / New age
3. Principles of computer Aided Design and Manufacturing / Fanlc / Amirouche / Pearson.
4. Computer Numerical Control Concepts and Programming / Warrens & Seames / Thomson

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2019-20)
MECHANICAL ENGINEERING (ME)

Year: III **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0513	Machine Learning	3	0	0	3

Course Outcomes:

CO: 1 Understand the concepts of computational intelligence like machine learning
CO: 2 Ability to get the skill to apply machine learning techniques to address the real time problems in different areas
CO: 3 Understand the Neural Networks and its usage in machine learning application
CO: 4
CO: 5

UNIT - I

Introduction - Well-posed learning problems, designing a learning system, Perspectives and issues in machine learning

Concept learning and the general to specific ordering – introduction, a concept learning task, concept learning as search, find-S: finding a maximally specific hypothesis, version spaces and the candidate elimination algorithm, remarks on version spaces and candidate elimination, inductive bias.

Decision Tree Learning – Introduction, decision tree representation, appropriate problems for decision tree learning, the basic decision tree learning algorithm, hypothesis space search in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning.

UNIT - II

Artificial Neural Networks-1– Introduction, neural network representation, appropriate problems for neural network learning, perceptions, multilayer networks and the back-propagation algorithm.

Artificial Neural Networks-2- Remarks on the Back-Propagation algorithm, An illustrative example: face recognition, advanced topics in artificial neural networks.

Evaluation Hypotheses – Motivation, estimation hypothesis accuracy, basics of sampling theory, a general approach for deriving confidence intervals, difference in error of two hypotheses, comparing learning algorithms.

UNIT - III

Bayesian learning – Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum Likelihood and least squared error hypotheses, maximum likelihood hypotheses for predicting probabilities, minimum description length principle, Bayes optimal classifier, Gibs algorithm, Naïve Bayes classifier, an example: learning to classify text, Bayesian belief networks, the EM algorithm.

Computational learning theory – Introduction, probably learning an approximately correct hypothesis, sample complexity for finite hypothesis space, sample complexity for infinite hypothesis spaces, the mistake bound model of learning.

Instance-Based Learning- Introduction, k-nearest neighbour algorithm, locally weighted regression, radial basis functions, case-based reasoning, remarks on lazy and eager learning.

UNIT- IV

Genetic Algorithms – Motivation, Genetic algorithms, an illustrative example, hypothesis space search, genetic programming, models of evolution and learning, parallelizing genetic algorithms.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2019-20)
MECHANICAL ENGINEERING (ME)

Learning Sets of Rules – Introduction, sequential covering algorithms, learning rule sets: summary, learning First - Order rules, learning sets of First-Order rules: FOIL, Induction as inverted deduction, inverting resolution.

Reinforcement Learning – Introduction, the learning task, Q–learning, non-deterministic, rewards and actions, temporal difference learning, generalizing from examples, relationship to dynamic programming.

UNIT - V

Analytical Learning-1- Introduction, learning with perfect domain theories: PROLOG-EBG, remarks on explanation-based learning, explanation-based learning of search control knowledge.

Analytical Learning-2-Using prior knowledge to alter the search objective, using prior knowledge to augment search operators.

Combining Inductive and Analytical Learning – Motivation, inductive-analytical approaches to learning, using prior knowledge to initialize the hypothesis.

TEXT BOOKS:

1. Machine Learning – Tom M. Mitchell - McGraw Hill Education, 2017

REFERENCES:

1. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis Chapman and Hall/CRC; 2nd edition, 2014

2. Machine Learning For Beginners: A Comprehensive Guide To Understand Machine Learning. How It Works And How Is Correlated To Artificial Intelligence And Deep Learning, Chris Neil, Alicex Ltd, 2020

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2019-20)
MECHANICAL ENGINEERING (ME)

Year: III **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0216	Neural Networks and Fuzzy Logic	3	0	0	3

Course Outcomes:

CO: 1 Understand the basic architecture of artificial neural network terminologies and techniques.
CO: 2 Understand approaches and architectures of Artificial Intelligence.
CO: 3 Perform the training of neural networks using various learning rules.
CO: 4 Create different neural networks of various architectures both feed forward and feed backward.
CO: 5 Application of ANN to System Identification and Pattern recognition.

UNIT – I ARTIFICIAL NEURAL NETWORKS

Approaches to AI – Architectures of AI – Symbolic Reasoning System – Rule based Systems – Knowledge Representation – Expert Systems. Introduction and motivation: Neural Network, Human Brain, Structure of biological neuron, Memory, Comparison between Artificial and Biological Neural Networks – Basic Building Blocks of ANN – Artificial Neural Network Terminologies, Artificial Intelligence and Neural Networks.

UNIT – II

Learning Process: Layers, activation functions, learning methods: Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive, Boltzmann Learning, Memory, Adaption, Back Propagation and Differentiation, Supervised Learning, unsupervised learning.

UNIT – III NETWORKS

Basic Building Blocks of ANN – Artificial Neural Network Terminologies – McCulloch Pitts Neuron Model – Learning Rules – ADALINE and MADALINE Models – Perceptron Networks – Back Propagation Neural Networks – Associative Memories - Self-Organization Map – Hopfield models – ART networks.

UNIT – IV UNIT – IV FUZZYLOGC

Classical Sets – Fuzzy Sets – Fuzzy Properties and Operations – Fuzzy Logic System Fuzzification – Defuzzification – Membership Functions – Fuzzy Rule base – Fuzzy Logic Controller Design.

UNIT – V FUZZY LOGIC APPLICATIONS

Fuzzy pattern recognition – Fuzzy control system – Aircraft landing control problem Statistical process control- Fuzzy cognitive mapping – Probability measures – Possibility and necessity measures.

TEXT BOOKS:

1. S. N. Sivanandam, S. Sumathi and S. N. Deepa, “Introduction to Neural Networks using MATLAB”, McGraw Hill Edition, 2006.
2. Timothy J. Ross, “Fuzzy Logic with Engineering Applications”, Third Edition, WILEY India Edition, 2012.

REFERENCES:

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2019-20)
MECHANICAL ENGINEERING (ME)

1. S. N. Sivanandam, S. Sumathi and S. N. Deepa, "Introduction to Fuzzy Logic using MATLAB", Springer International Edition, 2013.
2. Laurene V. Fausett "Fundamentals of Neural Networks: Architectures, Algorithms and Applications" United States Edition.
3. Yung C. Shin and Chengying Xu, "Intelligent System – Modeling, Optimization & Control, CRC Press, 2009

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO1: Engineering knowledge	1.3	1.3.1
CO: 2	PO1: Engineering knowledge	1.3	1.3.1
CO: 3	PO2: Problem analysis	2.4	2.4.1
CO: 4	PO1: Engineering knowledge	1.3	1.3.1
		1.4	1.4.1
CO: 5	PO1: Engineering knowledge	1.3	1.3.1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2019-20)
MECHANICAL ENGINEERING (ME)

Year: III **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19AOE0101	Structural Helath Monitoring	3	0	0	3

Course Outcomes:

CO: 1 Learn about failure and damage detection
CO: 2 Study the structural health monitoring in civil engineering structures
CO: 3 Know about Sensor technology in civil engineering
CO: 4 Study the IOT in SHM
CO: 5 Learn about Real time SHM application

UNIT I

INTRODUCTION: Failure of concrete, Deterioration of concrete, Repair techniques, NDT techniques, Structural health monitoring, Necessary of SHM.

UNIT II

STRUCTURAL HEALTH MONITORING: SHM techniques, SHM for construction materials, SHM for fresh concrete and harden concrete, SHM for Bridges

UNIT III

SENSORS in SHM: SHM monitoring parameters, Sensors and types of sensors in SHM, SHM working principal, Damage Identification and assessment

UNIT IV:

DATA PROCESSING: Data Acquistion System (DAS), IOT in SHM, AI in SHM, Energy harvesting technology in SHM, Static and Vibration based SHM

UNIT V

APPLICATION: Real time SHM application, Self-sensing concrete, Future of SHM

TEXT BOOKS:

1. Structural Health Monitoring, Daniel Balageas, Claus Peter Fritzen, Alfredo Guemes, John Wiley and Sons, 2006
2. Health Monitoring of Structural Materials and Components Methods with Applications

REFERENCES:

1. Structural Health Monitoring, Daniel Balageas, Claus_Peter Fritzen, Alfredo Güemes, John Wiley and Sons, 2006.
2. Health Monitoring of Structural Materials and Components_Methods with Applications, Douglas E Adams, John Wiley and Sons, 2007.
3. Structural Health Monitoring and Intelligent Infrastructure, Vol1, J. P. Ou, H. Li and Z. D. Duan, Taylor and Francis Group, London, UK, 2006.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2019-20)
MECHANICAL ENGINEERING (ME)

Year: III **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19AHE9902	Principles of Effective Public Speaking	3	0	0	3

Course Outcomes:

CO: 1 Gain and demonstrate the basic skills of effective oral communication, for use throughout your academic career and beyond.

CO: 2 Learn and develop the skills necessary to maximize public speaking effectiveness, including effective research and organization of information, how to make the most of presentation aids (and not become reliant on them!), and understanding the speaker-audience relationship.

CO: 3 Develop critical thinking and listening skills, enabling you to maximize your own understanding as an audience member, and offer considered and constructive critiques of others' speeches.

CO: 4 Become more confident in public speaking arenas, whether as a formal speech giver or as a participant in group settings. Improvement will be valued over perfection.

Unit -1

Introduction to Public Speaking:

Basic communication concepts, processes, and models Communication concepts and principles and public speaking Steps and methods of speech preparation; Ethics in public speaking

Unit -2

Listening and Speech Criticism:

Effective listening, the listening process, and types of listening; Listening barriers; Identifying and improving listening styles; Evaluating speech and effective speech techniques.

Unit -3

Selecting Topic and Knowing your Audience:

Identifying sources; Tools and techniques for selecting and refining speech topics; Identifying speech purposes; Central idea statement; The central idea; Audience analysis techniques.

Unit – 4

Speaking with a Purpose:

Informative, persuasive, and ceremonial speeches

Unit:5

Delivering your speech and using Visual Aids.

The mechanics of verbal and nonverbal communication in speech delivery; Modes of speech delivery; Speaking style and language; Effective delivery techniques; Incorporating presentation aids.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2019-20)
MECHANICAL ENGINEERING (ME)

References:

1. DeVito, J.A. (2009). The Essential Elements of Public Speaking. (3rd ed.) Boston: Pearson Education, Inc.
2. Lucas, S.E. (2009). The Art of Public Speaking. (10th ed.) New York: McGraw - Hill Co.
3. Zarefsky, D. (2011). Public Speaking: Strategies for Success. (6th ed. Boston: Pearson Education, Inc).

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO1	PO10: Communicate effectively on complex engineering	10.2	10.2.2
CO2	PO10: Communicate effectively on complex engineering.	10.2	10.2.1
CO3	PO9: Function effectively as an individual	9.2	9.2.1
CO4	PO10: Communicate effectively on complex engineering.	10.2	10.2.2
CO5	PO10: Communicate effectively on complex engineering.	10.3	10.3.1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2019-20)
MECHANICAL ENGINEERING (ME)

Year: III **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19AHE9904	Advanced Numerical Methods	3	0	0	3

Course Outcomes:

CO: 1 Understand the Formulation Techniques for solving problems used in engineering problems.
CO: 2 Apply the Curve Fitting procedures and understand Regression concept.
CO: 3 Analyses the Iterative methods of solving problems in Partial differential equations.
CO: 4 Know and be able to apply the procedure of solving the solution of Parabolic Equations.
CO: 5 Develop to solve techniques for solving problems in Hyperbolic partial differential equations. using

Unit I: Formulation Techniques: Methodology, Engineering problems and governing differential equations, finite elements, Variational methods- Raleigh Ritz method, Galerkin method.

Unit-II Curve fitting and approximation of functions: Least square approximation fitting of non-linear curves by least squares –regression analysis- multiple linear regression, non linear regression.

Unit III: Numerical solutions of partial differential equations: Introduction, classification of second order equations, finite difference approximation to derivatives, Iterative methods for Laplace's equation and Poisson `s equations.

Unit IV: Solution of Parabolic Equations: Bender –Schmidt Method-Bender – Schmidt Recurrence Equation, Crank-Nicholson Difference Method
Unit V: Solution of Hyperbolic partial differential equations: Solving wave equation by finite differences-stability of numerical method

Textbooks:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43/e, 2010.
2. Finite element methods by Chandraputla & Belagondu.
3."Numerical Methods for Engineers", Steven C.Chapra, Raymond P.Canale Tata Mc-Graw Hill

References:

1. Finite element procedures, . K. J. Bathe, Prentice -Hall, 1996
2. Erwin kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2006
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2008.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2019-20)
MECHANICAL ENGINEERING (ME)

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO1	PO2: Analyse complex engineering problems	2.1	2.1.3
CO2	PO1: Apply the knowledge of mathematics	1.1	1.1.2
CO3	PO1: Apply the knowledge of mathematics	1.1	1.1.2
CO4	PO1: Apply the knowledge of mathematics	1.1	1.1.2
CO5	PO1: Apply the knowledge of mathematics	1.1	1.1.2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2019-20)
MECHANICAL ENGINEERING (ME)

Year: III **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19AHE9908	Electromagnetic Theory	3	0	0	3

Course Outcomes:

CO: 1 Analyze electrostatics with their related theorems.
CO: 2 Illustrate electrostatics in matter by dielectrics and their properties.
CO: 3 Analyze Magnetostatics with mathematical proofs.
CO: 4 Analyze Maxwell's equations and Electromagnetic wave propagation.
CO: 5 Enumerate the applications of Electromagnetic wave propagation

UNIT I

Electrostatics

Introduction to Electrostatics – Gauss law – electrostatic potential – Poisson's and Laplace equations – Green's theorem – Green's functions (Basics only).

UNIT II

Electrostatics in Matter

lectrostatic field in matter – Dielectrics – Polarization – polarization vector – field outside polarized dielectric – bound charges – Electric displacement vector – Gauss law in presence of dielectrics – linear dielectrics –Boundary conditions in dielectric media.

UNIT III

Magnetostatics

Introduction to Magnetostatics – Conservation of charge and equation of continuity – Biot Savart's law – Magnetic field due to a localized current distribution – Ampere's law – Magnetic vector potential – magnetic scalar potential – magnetic moment, force and torque on a current distribution in an external field.

UNIT IV

Maxwell's Equations

Equation of continuity in electrodynamics – Faraday's law of induction – Maxwell's equations – Maxwell displacement current – Maxwell equations in differential and integral forms – Physical significance – Boundary conditions – Vector and scalar potentials - Gauge invariance –Coulomb and Lorentz gauges – Energy and momentum of the field – Introduction to four vectors- D' Alembertian Operator.

Unit 5: Wave Propagation

Propogation of electromagnetic waves in free space- Plane waves in a nonconducting media – Electromagnetic waves in conducting media – Reflection and refraction of EM waves at a plane interface and laws-Propagation of EM waves between parallel and perfectly conducting planes – Rectangular wave guide and circular wave guide-Basics of Antenna.

Text Books:

1. David. J.Griffiths – Introduction to Electrodynamics – Pearson Education; 4 edition (2015)
2. J.D.Jackson – Classical Electrodynamics – 3rdedition – John Wiley & Sons (2007)
3. B.B.Laud – Electromagnetics – New Age International Publisher; 3rd edition (2011)
4. Books Basic Electronic Engineering By B.L. Theraja

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2019-20)
MECHANICAL ENGINEERING (ME)

Reference Books:

1. J.R.Reitz, F.J.Milford and R.W.Christy – Foundations of Electromagnetic theory – 3rd edition – Addison Wesley (1980)
2. Wolfgang K. H. Panofsky, Melba Phillips- Classical Electricity and Magnetism: 2nd Edition- Courier Corporation (2012)

Web References:

1. www.physics.uq.edu.au/people/ficek/pdfs/ph3050.pdf
2. http://en.wikipedia.org/wiki/Main_Page
3. http://www-math.mit.edu/~djk/18_022/chapter12/section03.html
4. http://enphy.zhetao.com/booksec.dep?op=list&v=vi&conId=12174213324521329
5. http://www.cramster.com/electromagnetic-theory-lecture-notes-r26-18-cpi0-1.aspx

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO1 : Apply the knowledge of science	1.2	1.2.1
CO: 2	PO1: Apply the knowledge of science	1.2	1.2.1
CO: 3	PO1: Apply the knowledge of science	1.2	1.2.1
CO: 4	PO1: Apply the knowledge of science	1.2	1.2.1
CO: 5	PO1: Apply the knowledge of science	1.2	1.2.1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
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MECHANICAL ENGINEERING (ME)

Year: III **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19AMC9904	Professional Ethics and Human Values	3	0	0	3

Course Outcomes:

CO: 1 It ensures students sustained happiness through identifying the essentials of human values and skills.

CO: 2 The students will understand the importance of Values and Ethics in their personal lives and professional careers.

CO: 3 The students will learn the rights and responsibilities as an employee, team member and a global citizen.

CO: 4 Students understand practically the importance of trust, mutually satisfying human behavior and enriching interaction with nature. □

CO: 5 Students can able to develop appropriate technologies and management patterns to create harmony in professional and personal life

UNIT - I: **12hrs**

Introduction to Human Values: Need, basic Guidelines, Content and Process for Value Education, Self Exploration - 'Natural Acceptance' and Experiential Validation. Continuous Happiness and Prosperity - A look at basic Human Aspirations. Right understanding, Relationship and Physical Facilities. Understanding Happiness and Prosperity correctly.

UNIT - II: **12hrs**

Understanding Harmony in the Family and Society: Harmony in Human - Human Relationship: Understanding harmony in the Family the basic unit of human interaction. Understanding values in human - human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship. Understanding the harmony in the society (society being an extension of family). Visualizing a universal harmonious order in society - Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha) - from family to world family!

UNIT – III: **12hrs**

Introduction to Professional Ethics: Basic Concepts, Governing Ethics, Personal & Professional Ethics, Ethical Dilemmas, Life Skills, Emotional Intelligence, Thoughts of Ethics, Value Education, Dimensions of Ethics, Profession and professionalism, Professional Associations, Professional Risks, Professional Accountabilities, Professional Success, Ethics and Profession.

UNIT – IV: **15hrs**

Professional Practices in Engineering: Work Place Rights & Responsibilities, Professions and Norms of Professional Conduct, Norms of Professional Conduct vs. Profession; Responsibilities, Obligations and Moral Values in Professional Ethics, Professional codes of ethics, the limits of predictability and responsibilities of the engineering profession. Central Responsibilities of Engineers – The Centrality of Responsibilities of Professional Ethics; lessons from 1979 American Airlines DC-10 Crash and Kansas City Hyatt Regency Walk away Collapse.

UNIT – V: **12hrs**

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
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MECHANICAL ENGINEERING (ME)

Global issues in Professional Ethics: Introduction – Current Scenario, Technology Globalization of MNCs, International Trade, World Summits, Issues, Business Ethics and Corporate Governance, Sustainable Development Ecosystem, Energy Concerns, Ozone Depletion, Pollution, Ethics in Manufacturing and Marketing, Media Ethics, War Ethics, Bio Ethics, Intellectual Property Rights.

Text Books:

1.R. R. Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.
2.Professional Ethics: R. Subramanian, Oxford University Press, 2015. 3.Ethics in Engineering Practice & Research, Caroline Whitbeck, 2e, Cambridge University Press 2015.

Reference Books:

1. Prof. K. V. Subba Raju, 2013, Success Secrets for Engineering Students, Smart Student Publications, 3rd Edition.
2. Ivan IIIich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA
3. Engineering Ethics, Concepts Cases: Charles E Harris Jr., Michael S PritchaMichael J Rabins, 4e , Cengage learning, 2015.
4.Business Ethics concepts & Cases: Manuel G Velasquez, 6e, PHI, 2008

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO1	PO8: Ethics: Apply Ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice.	8.1	8.1.1
CO2	PO8:Ethics: Apply Ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice.	8.1	8.1.1
CO3	PO8: Ethics: Apply Ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice.	8.1	8.1.1
CO4	PO8: Ethics: Apply Ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice.	8.1	8.1.1
CO5	PO8: Ethics: Apply Ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice.	8.1	8.1.1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
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Year: III **Semester : II** **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
19APC0318	Heat Transfer Lab	0	0	2	1

Course Outcomes:

CO: 1 Estimate heat transfer coefficients in forced and natural convection and determine the effectiveness of heat exchangers and heat pipe.
CO: 2 Perform the transient heat conduction experiment and obtain the variations of temperature along length of pin-fin.
CO: 3 To determine overall heat transfer coefficient for composite walls
CO: 4 Perform experiment to determine thermal conductivity of metal rod.
CO: 5 Perform radiations experiments and determine the surface emissivity and Stefan boltzman's constant and compare the theoretical values.

1. Heat transfer coefficient in forced convection.
2. Heat transfer coefficient in natural convection
3. Thermal conductivity of insulating powder material through Concentric Sphere apparatus.
4. Thermal conductivity of insulating material through lagged pipe apparatus
5. Overall heat transfer co-efficient through Composite Slab Apparatus
6. Thermal Conductivity of metal (conductor).
7. Heat transfer in pin-fin
8. Experiment on Transient Heat Conduction
9. Experiment on Parallel and counter flow heat exchanger.
10. Emissivity of a gray body through Emissivity apparatus.
11. Experiment on Stefan Boltzman Apparatus.
12. Experiment on Critical Heat flux apparatus.
13. Study of heat pipe and its demonstration.
14. Study of Two – Phase flow.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
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Subject Code	Subject Name	L	T	P	Credits
19APC0320	Design & Simulation Lab	0	0	2	1

Course Outcomes:

CO: 1 Design of 2D models using software
CO: 2 Design of 3D models and analysis
CO: 3 Create simulation of any simple components
CO: 4 Design and simulation of machine components
CO: 5 Analysis of any components using software

List of experiments:

1. Any simple 2D drawing using CATIA. (4 Models)
2. 3D modelling using CATIA, Creo, Solidworks, etc., (4 Models)
3. Simulation of simple 3D models. (4 Models)