Title of the Course   :   Applied Thermodynamics – II
Category   :   PC
Course Code   :   19A351T
Year   :   III Year
Semester   :   I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
2	1	-	3

Course Objectives:

- To gain knowledge on thermodynamic vapour cycle used in thermal power plants.
- To become familiar with various boilers and draught.
- To understand functioning of nozzle, its types, and the study of nozzle characteristics.
- To provide a sound knowledge on condensers and cooling towers.
- To give better understanding on steam turbines and their performance characteristics.

Unit 1   Introduction to Steam Power Plant   10
Rankine's cycle - Schematic layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat addition, Methods to improve cycle performance – Regeneration – reheating- combined- cycles, Steam engines (elementary treatment).

Unit 2   Boilers   14
Classification based on Working principles - Fire tube boilers, water tube boilers – High pressure Boilers, boiler Mountings & Accessories. Performance of Boilers - Boilers horse power, equivalent evaporation, efficiency and heat balance – Draught: classification – Height of chimney for given draught and discharge, condition for maximum discharge, efficiency of chimney – artificial draught, induced and forced draught.

Unit 3   Steam Nozzles   08
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, its effects, degree of super saturation and degree of under cooling - Wilson line –Shock at the exit

Unit 4   Steam Condensers   08
Requirements of steam condensing plant, rare fraction – Classification of condensers – working principle of different types – vacuum efficiency and condenser efficiency – air leakage, sources and its effects, air pump- cooling water requirement. Cooling towers – Types-listing.

Unit 5   Steam Turbines   08
Steam Turbines - Impulse and reaction Turbines, Pressure and Velocity compounding of steam turbines, multistage reaction Turbines, reheat factor and Efficiency, degree of reaction.

Prescribed Text Books:
1. Rathore, Thermal Engineering. TMH.1st Ed.2010 - ISBN-13: 978-0070681132
2. P.K. Nag, Basic and Applied Thermodynamics.TMH. 2nd Ed.2010 - ISBN-10: 0070151318
3. M.L. Mathur& Mehta, Thermal Engineering. Jain bros. 3rd Ed.2013 - ISBN-10: 8183600832

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Reference Books:

1. R. Yadav, Thermodynamics and Heat Engines. Central Book Depot.6th ed.2012,ISBN 8185444021
2. R. S Khurmi & JS Gupta, Thermal Engineering. S.Chand. 14th Ed.1997. ISBN 9788121925730
3. Claus Borgnakke, Richard Edwin Sonntag, Fundamentals of Thermodynamics, Wiley,7th Ed.2009

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Evaluate the efficiency of steam power plant and recommend efficiency enhancement methods in improving the overall efficiency of the plant.	L1, L2, L3
2. Identify different types of boilers and their working, draughts and can calculate the chimney height for maximum discharge.	L1, L2, L3
3. Evaluate the performance characteristics of steam nozzles and different nozzles used in steam power plants.	L1, L2, L3
4. Evaluate the efficiency of steam condensers and the importance of cooling towers requirement in steam power plant.	L1, L2, L3
5. Calculate the performance parameters of turbines and can demonstrate the influence of governing mechanisms in steam power plants.	L1, L2, L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A351T.1	3	3	-	-	-	-	-	-	-	-	-	3	-	-	-
19A351T.2	3	3	3	-	-	1	1	-	-	-	-	3	-	2	-
19A351T.3	3	3	3	-	-	-	-	-	-	-	-	3	-	-	-
19A351T.4	3	3	-	-	-	-	-	-	-	-	-	3	-	-	-
19A351T.5	3	3	3	-	-	-	-	-	-	-	-	3	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course : Machine Tools
Category : PC
Course Code : 19A352T
Year : III Year
Semester : I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
2	1	-	3

Course Objectives:
- To get the basic knowledge of metal cutting theory and Learn about the geometry of cutting tools, chip formation, different forces acting on cutting tool and different cutting tool materials
- To become familiar with the different types of machines for machining with various constructional features and operations performed
- To become familiar with reciprocating machine tools, construction and its operations
- To become familiar with various grinding and super finishing operations by using different machining processes
- To become familiar with various work holding and tool holding devices

Unit 1   Fundamentals of Machining   12
Introduction to orthogonal and oblique cutting, Merchant Circle Diagram, Mechanics of Machining, types of chip, single point, Nomenclature (ORS & ASA) and multi-point cutting tools, forces in turning process; Cutting tool materials, tool wear, tool life and cutting fluids, Thermal aspects in machining – Economics of machining.

Unit 2   Lathe and Lathe operations   10
Centre lathe, constructional features, specifications, lathe operations – taper turning methods, thread cutting – calculations of machining time. Capstan and turret lathes-tool layout – Automatic lathes: semi-automatic – single spindle: Swiss type, automatic screw type – multi spindle

Unit 3   Reciprocating machine tools   10
Shaper, Planer and Slotter- Construction, Types and operations.
Drilling machines -construction, specifications, types, and operations performed – Reaming and Boring
Milling machines: types, working principle, Dividing head and Index, methods of indexing – Simple Indexing, Milling cutters types

Unit 4   Grinding and Super finishing process   10
Grinding wheel – Specification of grinding wheel and selection, types of grinding process– cylindrical grinding, surface grinding, Center less grinding, internal grinding- micro finishing methods - Typical applications – concepts of surface integrity.
Broaching machines: broach construction, types – push, pull broach.
Super finishing: Honing (Types and Construction), Lapping, Buffing, Burnishing and polishing process.

Unit 5   Jigs & Fixtures   06
Materials used in Jigs & Fixtures, Principles of work holding, design of Jigs and fixtures and uses, Classification of Jigs & Fixtures – Principles of location and clamping– Types of clamping - Typical examples of jigs and fixtures.

Prescribed Text Books:
1. Rao. P.N "Manufacturing Technology," Metal Cutting and Machine Tools, Tata McGraw- Hill, New Delhi, 2003,

ISBN - 9780070087699

2. Kalpak jian & Schmid, "Manufacturing Engineering & Technology", Pearson, 2005, ISBN - 8177581708
3. Joshi PH, "Jigs & Fixtures", New Delhi – Tata McGraw Hill Pub. Co. Ltd., 11th Print 1999. ISBN - 9780070680739

Reference Books:

1. Roy. A. Lindberg, "Process and materials of manufacture," PHI/Pearson Education fourth, Edition 2006, ISBN - 9788120306639
2. Geofrey Boothroyd, Fundamentals of Metal Machining and Machine Tools, McGraw Hill, 1984, ISBN - 1574446592
3. Hajra Choudhury & Nirjhar Roy S.K "Elements Of Workshop Technology -Volume II - Machine Tools" Media promoters and publishers Pvt. Ltd, ISBN - :81850991541

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understand the fundamentals of metal cutting, chip formation, cutting forces involved in orthogonal metal cutting, and different cutting forces, tool materials and cutting fluids will be learned	L2
2. Analyze the classification of cylindrical work parts and their operations performed on turning machines.	L4
3. Analyze the classification of various non-rotational work part machines with their constructional features and operations	L4
4. Evaluate the surface finishing operations with abrasive processes such as grinding and broaching machines, types and working principle.	L5
5. Analyzing the constructional features and the terminologies related to various types of Jigs and Fixtures.	L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A352T.1	3	3	3	3	-	3	3	3	-	-	-	-	-	3	-
19A352T.2	2	-	2	2	-	-	-	-	-	-	-	-	-	2	-
19A352T.3	2	-	2	2	-	-	-	-	-	-	-	-	-	2	-
19A352T.4	2	-	2	2	-	-	-	-	-	-	-	-	-	2	-
19A352T.5	1	1	1	1	-	1	1	1	-	-	-	1	-	1	-

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ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

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Title of the Course	:	Design of Machine Elements-I
Category	:	PC
Course Code	:	19A353T
Year	:	III Year
Semester	:	I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
2	1	-	3

Course Objectives:
- To provide an introduction to design of machine elements.
- To familiarize with fundamental approaches to failure prevention for static and dynamic loading.
- To explain design procedures to different types of joints.
- To familiarize with various theories related the design of machine elements for different loading conditions.

Unit 1   Introduction, Design for Static Loads   12

Introduction: General considerations of design, design process. Selection of Engineering materials - properties – Manufacturing considerations in the design. BIS codes of materials. Preferred numbers.

Design for static loads: Modes of failure, Design of components subjected to axial, bending, torsional and impact loads. Theories of failure for static loads.

Unit 2   Design for Dynamic Loads   10

Stress concentration –notch sensitivity, Types of fluctuating loads– Design for fluctuating stresses –finite life - Endurance limit - Estimation of Endurance limit – Soderberg, Goodman and Modified Goodman criterion for fatigue failure.

Unit 3   Design of Bolted, Rivetted and Welded joints   10

Design of Bolted Joints: Preload of bolts, various stresses induced in the bolts, torque requirement for bolt tightening, eccentrically loaded joints.

Design of Riveted joints: Design of lap, butt and eccentrically loaded joints, efficiency of Riveted joints.

Design of Welded Joints: Stresses of lap and butt welds, eccentrically loaded welded joints. Joints subjected to bending and torsion.

Unit 4 :   Design of Keys, Cotter and Knuckle Joints   08

Keys: Design of sunk, saddle, Kennedy and woodruff keys.

Cotter and Knuckle Joints: Socket and spigot joint, Sleeve and Cotter joints, Gib and Cotter joint, Knuckle joint.

Unit 5 :   Design of Shafts and Couplings   08

Shafts: Design of solid and hollow shafts bending, torsion, axial and combined bending and axial loading.

Shaft Couplings: Design of Rigid couplings-Muff, Split muff and Flange couplings-Flexible couplings: bushed pin type.

Prescribed Text Books:
1. V B Bhandari, Design of machine elements, 4th edition, TMH, 2017. ISBN 9780070611412
2. Pandya & Shah, Machine design, 20th edition, Charotar Publishers, 2009. ISBN : 978-93-85039-10-2
3. R.S. Khurmi & J.S.Gupta, Machine Design, S.Chand Publications, 2014. ISBN-13: 978-8121905015

Reference Books:

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1. J.E. Shigley, Machine design, TMH, 2015. ISBN-10: 9780073398204
2. T. Krishna Rao, Design of Machine Elements-I. I.K. International, 2010. ISBN 9789381141373
3. M.F. Spotts, Design of Machine Elements. PHI, 2006. ISBN 9788177584219
4. Kannaiah,Machine Design. Scietech, 2009. ISBN 13: 9788183711517
5. Machine Design, Schaum series, ISBN 13: 9780070255951.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Identify the suitable materials for machine elements, apply the codes and standards in design, and apply theories of failures in designing of machine elements subjected to static loads.	L1, L3
2. Apply theories of failures in designing of machine elements subjected to dynamic loads.	L3
3. Identify different types of joints; analyze stresses induced in joints subjected to different loads, and design different joints subjected to combined loading.	L1, L4, L6
4. Design keys, cotter and knuckle joints subjected to various loads.	L6
5. Design the shafts subjected to various loads, selection of shaft couplings for a given application and outline the design procedure.	L3, L6

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A353T.1	3	2	-	-	-	-	-	-	2	-	-	-	-	-	-
19A353T.2	3	3	-	-	-	-	-	-	2	-	-	-	-	-	-
19A353T.3	3	3	-	-	-	-	-	-	3	-	-	-	-	-	-
19A353T.4	3	3	-	-	-	-	-	-	3	-	-	-	-	-	-
19A353T.5	3	3	-	-	-	-	-	-	3	-	-	-	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

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Title of the Course	:	IC ENGINES
Category	:	PE
Course Code	:	19A35AT
Year	:	III Year
Semester	:	I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:

- To familiarize with the working of S.I. and C.I. engines and its important systems
- To acquaint with the various methods for measurement of engine performance
- To provide insight into the harmful effects of engine pollutants and its control
- To familiarize with the latest technological developments in engine technology

Unit 1 :   Introduction   07
I.C. ENGINES :Introduction Classification of I.C. Engines; Parts of I.C. Engine and their materials, Cycle of operation in Four stroke and Two-stroke IC engines and their comparative study; Fuel air cycles and their analysis, Actual working cycle, Valve Timing Diagram- Homogeneous charge compression Ignition, Rotary engine-Six stroke engine concept.

Unit 2 :   Combustion in SI ,Fuel Supply and Ignition System Engines   12
Combustion in SI Engines: Combustion phenomenon in SI Engines, Ignition delay, Flame propagation, Pressure Crank angle diagram, Abnormal combustion, Auto ignition, Detonation and Knocking, Factors affecting combustion and detonation& its control , Types of combustion chambers.
Fuel Supply System: Spark ignition Engine mixture requirements, Fuel-Air ratio, Simple carburetor and auxiliary circuits (excluding mathematical analysis of carburetors)
Injection systems: Single-point and Multipoint injection, Gasoline Direct Injection.
Ignition System: need of Ignition System, Working of Battery Ignition System, Magneto Ignition System and Electronic Ignition Systems.

Unit 3 :   Combustion in CI Engines and Fuel Supply System   12
Combustion in CI Engines: Combustion phenomenon in CI engines, Stages of combustion, Delay period, Knocking, Pressure-Crank angle diagram, Factors affecting combustion and knocking, Types of combustion chambers.
Fuel Injection Systems: Air injection systems, Airless/solid injection systems, Common rail, individual pump, distributor and unit systems. Injection pumps, Fuel injector, Types of nozzle, Electronically controlled unit fuel injection system.
Engine Cooling: Necessity of engine cooling, disadvantages of overcooling, Cooling systems and their comparison: Air cooling, Liquid cooling.
Engine lubrication: Types of lubricants and their properties, SAE rating of lubricants, Types of lubrication systems.
Supercharging/Turbo-charging: Objectives, Limitations, Methods and Types, Different arrangements of turbochargers and superchargers.

Unit 4 :   Engine Testing and Performance   08
Engine Testing and Performance: Measurement of Brake Power, Indicated Power, Frictional Power, Fuel Consumption, Air flow, BMEP, Performance characteristic of SI and CI Engine Effect of load and speed on Mechanical, Indicated Thermal, Brake Thermal and Volumetric efficiencies, Heat balance sheet.

Unit 5 :	Engine Exhaust Emission and its control and Alternative Fuels for IC Engines	06

Engine Exhaust Emission and its control: Constituents of exhaust emission at its harmful effect on environment and human health, Formation of NOx, HC, CO and particulate emissions, Methods of controlling emissions; Catalytic convertors, particulate traps, Exhaust Gas Recirculation, EURO and BHARAT norms

Alternative Fuels :Alcohol, Hydrogen, Natural Gas and Liquefied Petroleum Gas ,Biodiesel, Biogas, Producer Gas ,Properties, Suitability ,Engine Modifications, Merits and Demerits as fuels.

Prescribed Text Books:
1. V. Ganesan, I.C. Engines. TMH.6th edition, 2018. ISBN: 9781259006197
2. Thermal engineering, Rathore. TMH, 2018. ISBN: 9789353160845, 9353160847
3. Heywood, I.C. Engines. McGrawHill. 2nd edition, 2018. ISBN: 9781260116113, 1260116115

Reference Books:
1. Mathur& Sharma, IC Engines. DhanpathRai& Sons, 2016. ISBN: 9788170237440, 8170237440
2. Pulkrabek, Engineering fundamentals of IC Engines. Pearson, PHI, 4th edition, 2013. ISBN:9781292054971
3. Rajput, Thermal Engineering. Lakshmi Publications. 8th edition, 2010. ISBN: 9788131808047
4. R.S. Khurmi&J.K.Gupta, Thermal Engineering. S.Chand, 16th edition, 2016. ISBN: 9788121925730
5. Applied thermodynamics by Omkar Singh, 4th edition, New age Int.pub, 2015. ISBN: 9788122417630
6. B.Srinivasulu Reddy, Thermal engineering data book. JK International Pub, 2016. ISBN:978-81-89866-32-7
7. Rudramoorthy, Thermal Engineering. TMH, 2003. ISBN: 9780070494985

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Gain the knowledge on type of application of various engine systems used in I.C engines.	L1, L2
2. Understand the concept of combustion and Ignition system in SI engine.	L2
3. Understand the concept of combustion and Fuel Supply system in SI engine	L2
4. Conduct the performance test & estimating the performance of an I.C engines.	L2, L3
5. Show their ability to Justify Engine Exhaust Emission and its Control in IC Engine by Choosing Alternative Fuels.	L1, L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A35AT.1	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
19A35AT.2	3	3	3	3	-	-	1	-	-	-	-	-	-	2	-
19A35AT.3	3	3	3	-	-	-	-	-	-	-	-	3	-	2	-
19A35AT.4	3	3	3	3	-	-	-	-	-	1	-	3	-	2	-
19A35AT.5	3	3	3	3	-	1	-	-	-	-	-	3	-	2	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course	:	Design and Transmission System
Category	:	PE
Course Code	:	19A35BT
Year	:	III Year
Semester	:	I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:

- To gain knowledge on the principles and procedure for the design of Mechanical power transmission components.
- To understand the standard procedure available for Design of Transmission of Mechanical elements
- To learn to use standard data and catalogues (Use of P S G Design Data Book permitted)

Unit 1   Design Of Flexible Elements   08
Design of Flat belts and pulleys – Selection of V belts and pulleys – Selection of hoisting wire ropes and pulleys – Design of Transmission chains and Sprockets.

Unit 2   Spur Gears And Parallel Axis Helical Gears   10
Speed ratios and number of teeth-Force analysis -Tooth stresses – Dynamic effects – Fatigue strength – Factor of safety – Gear materials – Design of straight tooth spur & helical gears based on strength and wear considerations – Pressure angle in the normal and transverse plane- Equivalent number of teeth-forces for helical gears.

Unit 3   Bevel, Worm And Cross Helical Gears   10
Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears. Worm Gear: Merits and demerits terminology. Thermal capacity, materials-forces and stresses, efficiency, estimating the size of the worm gear pair. Cross helical: Terminology-helix angles-Estimating the size of the pair of cross helical gears.

Unit 4   Gear Boxes   10
Geometric progression – Standard step ratio – Ray diagram, kinematics layout -Design of sliding mesh gear box – Design of multi speed gear box for machine tool applications – Constant mesh gear box – Speed reducer unit. – Variable speed gear box, Fluid Couplings, Torque Converters for automotive applications.

Unit 5   Clutches And Brakes   10
Design of plate clutches –axial clutches-cone clutches-internal expanding rim clutches- Electromagnetic clutches. Band and Block brakes – external shoe brakes – Internal expanding shoe brake.
NOTE: Usage of Design Data Book is permitted in the University examination

Prescribed Text Books:

1. Bhandari V, "Design of Machine Elements", 4th Edition, Tata McGraw-Hill Book Co, 2016. ISBN 10: 9339221125 ISBN 13: 9789339221126
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 8th Edition, Tata McGraw-Hill, 2008. ISBN: 9780070668614, 0070668612

Reference Books:

1. Sundararaja moorthy T. V, Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003. ISBN: 9788184721188
2. Shigley J.E and Mischke C. R., "Mechanical Engineering Design", Sixth Edition, Tata McGraw - Hill , 2009. ISBN-10-007-14679-9
3. Data Books: (i) P.S.G. College of Technology (ii) BalaveerSwamy and Mahadevan

Tables/Codes: Design data books are to be supplied in examination

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Apply the concepts of design to belts, chains and rope drives.	L3
2. Apply the concepts of design to spur, helical gears.	L3
3. Apply the concepts of design to worm and bevel gears	L3
4. Apply the concepts of design to gear boxes	L3
5. Apply the concepts of design to cams, brakes and clutches	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A35BT.1	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
19A35BT.2	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
19A35BT.3	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
19A35BT.4	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
19A35BT.5	3	3	3	3	-	-	-	3	2	2	-	-	-	-	-

Title of the Course : Industrial Management
Category : PE
Course Code : 19A35CT
Year : III Year
Semester : I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:

- To create awareness to learn principles, concepts, functions of management and also to design organizational structures.
- To gain knowledge on plant location, layouts and analyze concepts of network techniques.
- To familiarize the students regarding work study and work sampling
- To train with materials and marketing management concepts in organizational context.
- To get awareness on Human Resource Management and its functions

Unit 1 :   Management and Organization   9
Concepts of Management and Organization – Functions of Management – Evolution of Management Thought: Taylor's Scientific Management, Fayol's Principles of Management - Systems Approach to Management. Basic concepts related to Organization - Departmentation and Decentralization, Types of organization, Line organization, Line and staff organization, functional organization, Committee organization, matrix organization and their merits and demerits

Unit 2 :   Plant Location & Project Management   12
Plant location, definition, factors affecting the plant location, comparison of rural and urban sites-methods for selection of plant. Plant Layout – definition, objectives, types of production, types of plant layout.
PERT & CPM Project management, network modeling-probabilistic model, various types of activity-times estimation-programme evaluation review techniques- Critical Path-probability of completing the project, deterministic model, critical path method -critical path calculation- crashing and Resource Leveling

Unit 3 :   Work Study   11
WORK STUDY: Definition, objectives, Method study - definition, objectives, steps involved- various types of associated charts-difference between micro-motion and memo-motion studies. Work measurement- definition, time study, steps involved-equipment, different methods of performance rating- allowances, standard time calculation. Work Sampling – definition, steps involved, standard time calculations, differences with time study- Applications. Predetermined motion time study – Method time measurement (MTM), introduction to ergonomics.

Unit 4 :   Materials Management   10
MATERIALS MANAGEMENT: Objectives, Inventory – functions, types, associated costs, inventory classification techniques. Stores Management and Stores Records. Purchase management, duties of purchase manager, associated forms. Marketing, selling, marketing mix, product life cycle.

Unit 5:   Human Resource Management   6
HUMAN RESOURCE MANAGEMENT: Functions of HRM, Job Evaluation, different types of evaluation methods. Job description, Merit Rating- difference with job evaluation, different methods of merit ratings, wage incentives, different types of wage incentive schemes.

Prescribed Text Books:
1. Armine, Manufacturing Organization and Management. Pearson, 2009, 6thed. ISBN-10: 8177582755
2. O.P. Khanna, Industrial Engineering and Management., DhanpatRai, 2018,17thed ISBN-10: 818992835X
3. Stoner, Freeman, Gilbert, Management, Pearson Edu., 2007, 6th Ed. ISBN: 9788131707043
4. Pannerselvam, Production and Operations Management. PHI, 2010 ISBN-10: 9788120345553

Reference Books:
1. Ralph M Barnes, Motion and Time Studies. John Wiley and Sons, 2007. ISBN: 978-0-471-05905-9
2. Chase, Jacobs, Aquilano, Operations Management. TMH, 2007, 10th Ed. ISBN-10: 0071215557
3. L.S. Srinath, PERT/CPM. East-West Press, 2005. ISBN 10: 8185336202

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Discuss the principles and functions of management & decide the competitive strategy that works best for the organization	L3 & L4
2. Understand the importance of plant locations and develop effective project management techniques	L3, L4 & L5
3. Understand the concept of work study, method study and types of associated charts, the work measurement, work sampling and their steps	L3
4. Learn the concepts of material management and apply the knowledge of inventory management and marketing strategies in work setting	L3
5. Discuss the importance of various sub systems of HRM	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A35CT.1	3	-	-	-	-	-	-	-	3	3	-	3	-	-	-
19A35CT.2	3	3	-	3	-	-	-	-	-	-	3	-	-	2	-
19A35CT.3	3	3	-	3	-	-	-	-	-	-	-	3	-	-	-
19A35CT.4	3	3	-	-	-	1	-	-	3	3	3	3	-	-	-
19A35CT.5	-	-	-	-	-	-	-	1	3	3	-	-	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course	:	Optimization Techniques through MATLAB
Category	:	PE
Course Code	:	19A35DT
Year	:	III Year
Semester	:	I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:
- To Introduce basics of MATLAB
- To Familiarize the fundamentals of optimization
- To Explain single variable optimization using various methods
- To Implement multi variable optimization using various methods
- To Train various evolutionary algorithms.

Unit 1   Introduction to MAT LAB   08
Introduction to MAT LAB: Overview, MATLAB Preliminaries, Basics of MATLAB, Beyond the Basics of MATLAB, Popular Functions and Commands, Plotting using MATLAB, Optimization with MATLAB.

Unit 2   Introduction to Optimization   08
Introduction to Optimization: Statement of an optimization problem, Classifications of optimization Problems: Single variable optimization, Multi variable optimization with no constraints, Multi variable optimization with equality constraints, Multi variable optimization.

Unit 3   Single Variable Optimization   08
Single Variable Optimization: Finite difference method, Central difference method, Runge-Kutta method, interval halving method, golden section method with MATLAB code.

Unit 4   Multi Variable Optimization   09
Multi Variable Optimization: Conjugate gradient method, Newton's method, Powell's method, Flectcher- Reeves method, Hook and Jeeves method, interior penalty function with MATLAB code.

Unit 5   Evolutionary Algorithms   09
Evolutionary Algorithms: Overview, Genetic Algorithms: Basics of Genetic Algorithms, Options in MATLAB, Multi Objective Optimization using Genetic Algorithms, Ant Colony Optimization, Simulated Annealing, Particle Swarm Optimization.

Prescribed Text Books:
1. Rao V.Dukkipati, MATLAB: An Introduction with Applications, Anshan, 2010. ISBN 1848290438, 9781848290433
2. AchilleMessac, Optimization in practice with MATLAB, Cambridge University Press, 2015. ISBN 1107109183, 9781107109186
3. Jasbir S Arora, Introduction to optimum design, 2/e. Elsevier, 2004.Hardcover. ISBN: 9780120641550, eBook ISBN: 9780080470252

Reference Books:
1. Cesar Perez Lopez, MATLAB Optimization Techniques, Academic press, Springer publications, 2014. ISBN: 1484202929, 9781484202920

2. Steven C. Chapra, Applied Numerical Methods with MATLAB for Engineers and scientists, 4/e, McGraw-Hill Education, 2018.ISBN-10: 0073397962. ISBN-13: 978-0073397962

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. use optimization terminology and concepts, and understand how to classify an optimization problem	L4
2. apply optimization methods to engineering problems	L3
3. Implement optimization algorithms.	L3
4. Compare different genetic algorithms.	L5
5. Solve multivariable optimization problems.	L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A35DT.1	3	2	2	3	2	2	-	-	2	-	3	2	2	2	2
19A35DT.2	3	2	2	3	2	2	-	-	2	-	3	2	2	2	2
19A35DT.3	3	2	2	3	2	2	-	-	2	-	3	2	2	2	2
19A35DT.4	3	2	2	3	2	2	-	-	2	-	3	2	2	2	2
19A35DT.5	3	2	2	2	2	2	-	-	2	-	3	2	2	2	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course   :   Automobile Engineering
Category   :   PE
Course Code   :   19A35ET
Year   :   III Year
Semester   :   I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:
- To gain the basic knowledge on automobile components and its electrical systems.
- To understand various fuel supply systems and their emission control techniques.
- To acquire knowledge on cooling and ignition systems used in automobiles.
- To obtain knowledge on power transmission systems.
- To get the basic idea on steering, suspension, and braking systems employed in automobiles.

Unit 1   Introduction   10
Introduction: Components of a four wheeler automobile – chassis and body – power unit –power transmission – rear wheel drive, front wheel drive, 4 wheel drive – types of automobile engines, engine construction, turbo charging and super charging – oil filters, oil pumps – crank case ventilation.
Electrical System :Charging circuit, generator, current – voltage regulator – starting system, Bendix drive, mechanism of Solenoid switch, Lighting systems, Horn, wiper, Fuel gauge – oil pressure gauge, Engine temperature indicator.

Unit 2   Emissions And Its Control   09
Emissions And Its Control: Pollution standards National and international –formation of emissions - Pollution Control Techniques – Common rail diesel injection Emissions from alternative energy sources, Exhaust gas recirculation, HCCI engine, particulate traps and Selective catalytic converter – hydrogen, Biomass, alcohols, LPG, CNG - their merits and demerits.

Unit 3   Transmission System   09
Transmission System: Clutches- Principle- types: cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel – gear box- types: sliding mesh, constant mesh, synchromesh, epi-cyclic, over drive, torque converter. Propeller shaft – Hotch – Kiss drive, Torque tube drive, universal joint, differential, rear axles.

Unit 4   Steering System, Suspension System and Braking System   10
Steering System: Steering geometry – camber, castor, king pin rake, combined angle toe-in, center point steering. Steering gears – types, steering linkages.
Suspension System: Objects of suspension systems – rigid axle suspension system, torsion bar, shock absorber, Independent suspension system.
Braking System: Mechanical brake system, Hydraulic brake system, Pneumatic and vacuum brake systems, Antilock braking system and Traction control.

Unit 5   Safety System   08
Safety System: Antilock braking system, air bag restraint system, voice warming system, seat belt system, road navigating system, anti theft system.

Prescribed Text Books:

1. Kirpal Singh, Automotive Mechanics –Vol.1&Vol.2., standard publisher's distributors, 13th Ed.2013. ISBN: 9788180142062
2. John Heywood, Internal combustion engine fundamentals, McGraw-hill 1988. ISBN: 9781260116106
3. William Crouse, Automobile Engineering. 10th Ed.2006. ISBN: 9780070634350

Reference Books:

1. K.K. Ramalingam, Automobile Engineering. SciTech Publ.3rdEd.2011. ISBN: 9788188429486
2. Newton, Steeds & Garret, Automotive Engines. ISBN 10: 1560918985
3. Richard Stone, Jeffrey K. Ball, (2004), Automotive Engineering Fundamentals" SAE International. ISBN: 9780768009873
4. G.B.S. Narang, Automobile Engineering (2009), Khanna Publishers. ISBN :9789387394254
5. S. Srinivasan, Automotive Mechanics, 2nd Ed., Tata McGraw Hill 2003. ISBN: 9780070494916
6. Judge. A.W., Modern Electrical Equipment of Automobiles, Chapman & Hall, London, 1992. ISBN :9789401168816
7. R.B. Gupta, Automobile Engineering (2011-12), Tech India Publications. ISBN: 9788176848589, 8176848581

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. To gain the knowledge on components and electrical system on four wheeler automobile.	L2
2. Enrich the standards in emission and its control techniques in automobiles.	L2
3. Acquire knowledge on transmission system of an automobile.	L2
4. Understand purpose of steering system, suspension system, braking system and their identification.	L2
5. Show their ability to identify different safety system used in automobile.	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19AC11T.1	-	-	3	-	3	-	-	-	-	-	-	3	-	-	-
19AC11T.2	-	-	3	1	3	-	1	-	-	-	-	3	-	-	-
19AC11T.3	-	-	3	-	3	-	-	-	-	-	-	3	-	-	-
19AC11T.4	-	-	3	-	3	-	-	-	-	1	-	3	-	-	-
19AC11T.5	-	-	-	-	-	1	-	-	-	-	-	3	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course : Design For Manufacturing
Category : PE
Course Code : 19A35FT
Year : III Year
Semester : I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:
- To explain the product development cycle and manufacturing issues to be considered in design.
- To familiarize manufacturing consideration in cast, forged, and weld components.
- To describe the manufacture of sheet metal components.
- To impart knowledge plastics as substitution to metallic parts.

Unit 1   Introduction   10
Introduction: Design philosophy-steps in design process-general design rules for manufacturability-basic principles of designing for economical production-creativity in design.
Materials: Selection of materials for design-developments in material technology-criteria for material selection-material selection interrelationship with process selection-process selection charts

Unit 2 :   Machining processes   09
Machining processes: Overview of various machining processes-general design rules for machining-dimensional tolerance and surface roughness-Design for machining – ease –redesigning of components for machining ease with suitable examples. General design recommendations for machined part

Unit 3   Metal casting and Metal joining   12
Metal casting: Appraisal of various casting processes, selection of casting process,-general design considerations for casting-casting tolerance-use of solidification, simulation in casting design-product design rules for sand casting.
Metal joining: Appraisal of various welding processes, factors in design of weldments – general design guidelines-pre and post treatment of welds-effects of thermal stresses in weld joints-design of brazed joints.

Unit 4   Forging, Extrusion & Sheet metal work   08
Forging: Design factors for forging – closed die forging design – parting lines of dies – drop forging die design – general design recommendations.
Extrusion & Sheet metal work: Design guide lines extruded sections-design principles for punching, blanking, bending, deep drawing-Keeler Goodman forging line diagram – component design for blanking.

Unit 5 :   Plastics   10
Plastics: Visco elastic and creep behavior in plastics-design guidelines for plastic components-design considerations for injection moulding – design guidelines for machining and joining of plastics.

Prescribed Text Books:
1. George E Dieter and Linda Schmidt, Engineering Design, 4th Edition, McGraw Hill (2015) ISBN: 9780073398143
2. A.K.Chitale and R.C.Gupta, Product Design and Manufacturing, 5th Edition, PHI Learning (2011). ISBN-10: 8120342828
3. David M Anderson, Design for Manufacturability, CRC Press (2013). ISBN: 9781482204926

Reference Books:

1. James G Bralla, Design For Manufacturability Handbook, 2nd Edition, McGraw Hill (2004). ISBN: 9780070071391
2. Dr. P.C.Sharma, Production Technology, S.Chand & Company (2009). ISBN-10 : 8121911141

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Design mechanical components with economical consideration	L1
2. Select materials and machining processes.	L1
3. Identify the necessity for redesigning components out of manufacturing considerations.	L1
4. Consider the manufacturing considerations while designing cast, forged weld and sheet metal components	L1
5. Design plastic parts with manufacturing considerations	L1

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A35FT.1	1	-	3	1	-	-	-	1	-	-	-	-	1	2	-
19A35FT.2	1	-	2	1	1	-	-	1	-	-	-	-	1	2	-
19A35FT.3	1	-	2	1	-	-	-	1	-	-	-	-	1	2	3
19A35FT.4	1	-	2	1	1	-	-	-	-	-	-	-	1	-	3
19A35FT.5	1	-	3	-	-	-	-	-	-	-	-	-	1	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course : Non-Destructive Testing
Category : PE
Course Code : 19A35GT
Year : III Year
Semester : I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:
- To introduce basic concepts of nondestructive testing.
- To familiarize with characteristics of ultrasonic test, transducers, rejection and effectiveness.
- To describe concept of liquid Penetrant, eddy current and magnetic particle tests, its applications and limitations.
- To explain the principles of infrared and thermal testing, applications and honey comb and sandwich structures case studies.
- To impart NDE and its applications in pressure vessels, casting and welded constructions

Unit 1: Introduction to non-destructive testing   06
Radiographic test, Sources of X and Gamma Rays and their interaction with Matter, Radiographic equipment, Radiographic Techniques, Safety Aspects of Industrial Radiography.

Unit 2: Ultrasonic Testing   10
Principle of Wave Propagation, Reflection, Refraction, Diffraction, Mode Conversion and Attenuation, Sound Field, Piezo-electric Effect, Ultrasonic Transducers and their Characteristics, Ultrasonic Equipment and Variables Affecting Ultrasonic Test, Ultrasonic Testing, Interpretations and Guidelines for Acceptance, Rejection - Effectiveness and Limitations of Ultrasonic Testing.

Unit 3 : Liquid Penetrant, Eddy Current & Magnetic Particle Testing   12
Liquid Penetrant Test, Basic Concepts, Liquid Penetrant System, Test Procedure, Effectiveness and Limitations of Liquid Penetrant Testing. Principle of Eddy Current, Eddy Current Test System, Applications of Eddy Current-Testing Effectiveness of Eddy Current Testing. Magnetic Materials, Magnetization of Materials, Demagnetization of Materials, Principle of Magnetic Particle Test, Magnetic Particle Test Equipment, Magnetic Particle Test Procedure, Standardization and Calibration, Interpretation and Evaluation, Effective Applications and Limitations of the Magnetic Particle Test.

Unit 4 : Infrared and Thermal Testing: 10
Introduction and fundamentals to infrared and thermal testing–Heat transfer –Active and passive techniques –Lock in and pulse thermography–Contact and non-contact thermal inspection methods–Heat sensitive paints –Heat sensitive papers –-thermally quenched phosphors liquid crystals –techniques for applying liquid crystals –other temperature sensitive coatings –Inspection methods –Infrared radiation and infrared detectors–thermo mechanical behavior of materials–IR imaging in aerospace applications, electronic components, Honey comb and sandwich structures–Case studies.

Unit 5 : Industrial Applications of NDE   08
Span of NDE Activities Railways, Nuclear, Non-nuclear and Chemical Industries, Aircraft and Aerospace Industries, Automotive Industries, Offshore Gas and Petroleum Projects, Coal Mining Industry, NDE of pressure vessels, castings, welded constructions

Prescribed Text Books:

1. J Prasad, GCK Nair , Nondestructive test and evaluation of Materials, Tata mcgraw-Hill Education Publishers, 2008. ISBN:9780070620841
2. Josef Krautkrämer, Herbert Krautkrämer, Ultrasonic testing of materials, 3/e, Springer-Verlag, 1983. ISBN 978-3-662-10680-8
3. X. P. V. Maldague, Non destructive evaluation of materials by infrared thermography, 1/e, Springer-Verlag, 1993. ISBN 978-1-4471-1995-1

Reference Books:

1. Gary L. Workman, Patrick O. Moore, Doron Kishoni, Non-destructive, Hand Book, Ultrasonic Testing, 3/e, Amer Society for Nondestructive, 2007. ISBN-10: 1571171630
2. ASTM Standards, Vol 3.01, Metals and alloys. ISBN 978-1-6822-1620-0

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Gain knowledge of the basic principles, techniques, applications and limitations of basic NDT methods.	L3
2. Understand the basic principles of Ultrasonic Testing.	L3
3. Apply relevant non-destructive testing method different applications	L2
4. Explain various methods of Infraredand Thermal testing.	L2
5. Outline the applications, limitations and disadvantages of NDE	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A35GT.1	3	3	-	-	3	3	-	-	-	-	-	-	-	-	2
19A35GT.2	3	3	-	-	3	3	-	-	-	-	-	-	-	-	2
19A35GT.3	3	3	-	-	3	3	-	-	-	-	-	-	-	-	2
19A35GT.4	3	3	-	-	3	3	-	-	-	-	-	-	-	-	2
19A35GT.5	3	3	-	-	3	3	-	-	-	-	-	-	1	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course	:	Automation and Robotics
Category	:	PE
Course Code	:	19A35HT
Year	:	III Year
Semester	:	I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:
- To acquire basic knowledge on automation and automated flow lines in automatic manufacturing systems.
- To learn about the line balancing methods and automated assembly systems.
- To learn about the robotics and fundamentals of robots with their needs in present trend.
- To understand robot kinematics, dynamics and to acquire knowledge on importance of trajectory planning in robots.
- To learn about the sensors, actuators and robot programming methods used in robots.

Unit 1   Introduction to Automation   07
Need, Types, Basic elements of an automated system, levels of automation, hardware components for automation and process control, automation principles, Automation strategies
AUTOMATED FLOW LINES: Part transfer methods and mechanisms, types of Flow lines, flow line with/without buffer storage

Unit 2   Assembly Systems and Line Balancing   08
The Assembly Process, Assembly Systems, Manual Assembly Lines, The Line Balancing Problem, Methods of Line Balancing, Computerized Line Balancing Methods, Other ways to improve the Line Balancing, Flexible Manual Assembly Lines. Automated Assembly Systems: Design for Automated Assembly, Types of Automated Assembly Systems, Part Feeding Devices, Analysis of Multi-station Assembly Machines, Analysis of a Single Station Assembly Machine

Unit 3 :   Introduction to Industrial Robots   07
Need for robots in Present customization, Classification, laws of robots. Robot configurations, Functional line diagram, Degrees of Freedom, Components, common types of arms, joints, grippers, applications.

Unit 4 :   Manipulator Kinematics, Dynamics & Trajectory Planning   08
Manipulator Kinematics: Homogeneous transformations as applicable to rotation and translation - D-H notation, Forward and inverse kinematics
Manipulator dynamics: Differential transformation, Jacobians. Lagrange – Euler
Trajectory Planning: Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion – straight line motion.

Unit 5 :   Robot- Actuators, Sensors, Programming   07
Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors, comparison Position sensors – potentiometers, resolvers, encoders – Velocity sensors, tactile sensors, Proximity sensors.
Robot Programming: Types – features of languages and software packages.

Prescribed Text Books:

1. M.P.Groover, Automation, Production systems and CIM. Pearson Edu 2004. ISBN-10: 9789332572492, ISBN-13: 978-9332572492
2. M.P. Groover, Industrial Robotics. TMH 2003. ISBN-10 : 007024989X

Reference Books:

1. Fu KS, Robotics. McGraw Hill. 2014. ISBN: 9780071822282
2. Coiffet and M.Chaironze, An Introduction to Robot Technology. Kogam Page Ltd. London, 1983. ISBN 978-94-011-6100-8
3. Richard D.Klafter, Robotics Engineering. Prentice Hall. 1989. ISBN-10 : 0134687523
4. Ashitave Ghosal, Robotics, fundamental Concepts and analysis. Oxford Press, 2006. ISBN-10 : 0195673913
5. Mittal RK &Nagrath IJ, Robotics and Control. TMH 2003. ISBN-10 : 9780070482937
6. Saha, S.K., Introduction to Robtics, Second Edition McGraw Hill New Edition 2014. ISBN: 9789332902800.
7. Niku Saeed B., Introduction to Robotics:Analysis, systems, Applications, PHI New Delhi. ISBN-10: 0130613096
8. John J. Craig, Introduction to Robotics. Pearson Edu 2017. ISBN: 0133489795

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understand and apply the knowledge on automation and the automated flow lines in real working environment.	L2
2. Learn the importance of line balancing methods and are able to design the assembly work stations in industrial assembly plants.	L3
3. Understand the robotics and the fundamental concepts of robots.	L2
4. learn concept of robot kinematics, dynamics and trajectory planning methods and are able to apply this concept in academic research	L3
5. Understand the sensors, actuators and robot programming methods used in robots and can develop a suitable program and create the solutions for contemporary issues.	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A35HT.1	3	3	-	-	-	-	-	-	-	-	-	3	-	-	3
19A35HT.2	3	3	2	-	2	-	-	-	-	-	-	3	2	2	3
19A35HT.3	3	3	-	-	-	-	-	-	-	-	-	3	-	-	3
19A35HT.4	3	3	2	-	2	-	-	-	-	-	-	3	2	2	3
19A35HT.5	3	3	-	-	-	-	1	-	-	-	-	3	1	1	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course   :   Rapid Prototyping
Category   :   OE
Course Code   :   19A35IT
Year   :   III Year
Semester   :   I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:
- To familiarize techniques for processing of CAD models for rapid prototyping
- To explain fundamentals of rapid prototyping techniques
- To demonstrate appropriate tooling for rapid prototyping process
- To focus Rapid prototyping techniques for reverse engineering
- To train Various Pre – Processing, Processing and Post Processing errors in RP Processes

Unit 1   10
Introduction: Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Need for time compression in product development, Usage of RP parts, Generic RP process, Distinction between RP and CNC, other related technologies, Classification of RP.
RP Software: Need for RP software, MIMICS, Magics, Surgi Guide, 3-matic, 3D-Doctor, Simplant, Velocity2, VoXim, Solid View, 3DView, etc., software, Preparation of CAD models, Problems with STL files, STL file manipulation, RP data formats: SLC, CLI, RPI, LEAF, IGES, HP/GL, CT, STEP.

Unit 2   08
Solid and Liquid Based RP Systems:
Stereo lithography (SLA): Principle, Process, Materials, Advantages, Limitations and Applications.
Solid Ground Curing (SGC): Principle, Process, Materials, Advantages, Limitations, Applications.
Fusion Deposition Modeling (FDM): Principle, Process, Materials, Advantages, Limitations, Applications. Laminated Object Manufacturing (LOM): Principle, Process, Materials, Advantages, Limitations, Applications.

Unit 3   08
Powder Based RP Systems: Principle and Process of Selective Laser Sintering (SLS), Advantages, Limitations and Applications of SLS, Principle and Process of Laser Engineered Net Shaping (LENS), Advantages, Limitations and Applications of LENS, Principle and Process of Electron Beam Melting (EBM), Advantages, Limitations and Applications of EBM.
Other RP Systems:
Three-Dimensional Printing (3DP): Principle, Process, Advantages, Limitations and Applications.
Ballastic Particle Manufacturing (BPM): Principle, Process, Advantages, Limitations, Applications.
Shape Deposition Manufacturing (SDM): Principle, Process, Advantages, Limitations, Applications.

Unit 4   08
Rapid Tooling: Conventional Tooling Vs. Rapid Tooling, Classification of Rapid Tooling, Direct and Indirect Tooling Methods, Soft and Hard Tooling methods.
Reverse Engineering (RE): Meaning, Use, RE – The Generic Process, Phases of RE Scanning, Contact Scanners and Noncontact Scanners, Point Processing, Application Geometric Model, Development.

Unit 5   08
Errors in RP Processes: Pre-processing, processing, post-processing errors, Part building errors in SLA, SLS, etc.
RP Applications: Design, Engineering Analysis and planning applications, Rapid Tooling, Reverse Engineering, Medical Applications of RP.

Prescribed Text Books:
1. Chua C.K., Leong K.F. and Lim C.S., Rapid Prototyping: Principles and Applications, 2/e Edition, World Scientific Publishers, 2010. ISBN: 9789812778987, 9789812778987
2. Ian Gibson, David W. Rosen, Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, 1st Edition, Springer, 2010. ISBN: 978-1-4419-1119-3
3. Ma W. and Venu Vinod P., Rapid Prototyping and Other Laser based processes, 2004, Kluwer Academic Press.ISBN 978-1-4419-5388-9.

Reference Books:
1. Liou W. Liou, Frank W., Liou, Rapid Prototyping and Engineering Applications: A Tool Box for Prototype Development, CRC Press, 2007. ISBN 0849334098.
2. Pham D.T. and Dimov S.S., Rapid Manufacturing; The Technologies and Application of RPT and Rapid tooling, Springer, London 2001. ISBN 978-1-4471-1182-5
3. Gebhardt A., Rapid prototyping, Hanser Gardener Publications, 2003. ISBN 9781591248682.

Course Outcomes:
Student will be able to   Blooms Level of Learning
1. Use techniques for processing of CAD models for rapid prototyping   L3
2. Understand and apply fundamentals of rapid prototyping techniques   L3
3. Use appropriate tooling for rapid prototyping process   L3
4. Use rapid prototyping techniques for reverse engineering   L3
5. Identify Various Pre – Processing, Processing and Post Processing errors in   L3
    RP processes

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A35IT.1	3	3	3	2	2	-	-	-	-	-	-	-	-	3	-
19A35IT.2	3	3	3	2	2	-	-	-	-	-	-	-	-	3	-
19A35IT.3	3	3	3	2	2	-	-	-	-	-	-	-	-	3	-
19A35IT.4	3	3	3	2	2	-	-	-	-	-	-	-	-	3	-
19A35IT.5	3	3	3	2	2	-	-	-	-	-	-	-	-	3	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course   :   Industrial Robotics
Category   :   OE
Course Code   :   19A35JT
Year   :   III Year
Semester   :   I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:
- To learn about the robotics and fundamentals of robots with their needs in present trend.
- To understand robot kinematics and robot dynamics, able to acquire knowledge on importance of trajectory planning in robots.
- To learn about the sensors, actuators and robot programming methods used in robots, and the applications of robots.

Unit 1   Introduction To Industrial Robots   10
Classification. Robot configurations, Functional line diagram, Degrees of Freedom. Components, common types of arms, joints, grippers.

Unit 2   Manipulator Kinematics   10
Homogeneous transformations as applicable to rotation and translation - D-H notation, Forward and inverse kinematics.
Manipulator Dynamics: Differential transformation, Jacobians. Lagrange – Euler

Unit 3   Trajectory Planning   10
Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion – straight line motion.

Unit 4   Robot Actuators And Feedback Components   10
Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors, comparison Position sensors – potentiometers, resolvers, encoders – Velocity sensors, tactile sensors, Proximity sensors.

Unit 5   Robot programming   10
Types – features of languages and software packages.
Robot Application In Manufacturing: Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

Prescribed Text Books:
1. M.P.Groover, Automation, Production systems and CIM. Pearson Edu. ISBN-13: 9780133499612.
2. M.P. Groover, Industrial Robotics. TMH. ISBN 10: 1259006212 ISBN 13: 9781259006210
3. Saeed B Niku, Introduction to robotics : analysis, control, applications. 2019. ISBN: 978-1-119-52760-2

Reference Books:
1. Benedict. G.F. "Nontraditional Manufacturing Processes" Marcel Dekker Inc., New York. 2019. ISBN 9780367403393
2. Pandey P.C. and Shan H.S. "Modern Machining Processes" Tata McGraw- Hill, New Delhi (1980). ISBN: 9780070965539

3. Mc Geough, "Advanced Methods of Machining" Chapman and Hall, London (1998) 42 Industrial Robotics 3.0, 2014. ISBN: 9789400784826

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understand the robotics and the fundamental concepts of robots.	L2, L3
2. Learn concept of robot kinematics, dynamics and are able to apply these concept in academic research.	L2, L3
3. Learn concept of robot trajectory planning methods and are able to apply these concept in academic research.	L2, L3
4. Understand the sensors, actuators and create the solutions for contemporary issues.	L2, L3
5. Understand the robot programming methods used in robots and the applications of robots can develop a suitable program and create the solutions for contemporary issues.	L2, L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A35JT .1	3	2	-	3	-	-	-	-	-	-	-	2	-	-	-
19A35JT.2	3	3	3	3	1	-	-	-	-	-	-	2	-	-	-
19A35JT .3	3	2	-	3	-	-	-	-	-	-	-	2	-	-	-
19A35JT .4	3	3	3	3	1	-	-	-	-	-	-	2	-	-	-
19A35JT.5	3	3	-	3	-	-	3	-	-	-	-	2	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course   :   Entrepreneurship Development
Category   :   OEC
Course Code   :   19A35KT
Year   :   III Year
Semester   :   I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:
- To develop and strengthen entrepreneurial quality and motivation in students
- To impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.

Unit 1   Entrepreneurship   09
Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

Unit 2   Motivation   09
Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self-Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.

Unit 3   Business   10
Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

Unit 4   Financing And Accounting   09
Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Taxation – Income Tax, Excise Duty – Sales Tax.

Unit 5   Support To Entrepreneurs   09
Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures
- Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting

Prescribed Text Books:
1. Khanka. S.S., "Entrepreneurial Development" S.Chand& Co. Ltd., Ram Nagar, New Delhi, 2013. ISBN : 81-219-1801-4
4. Donald F Kuratko, "Entreprenuership – Theory, Process and Practice", 9th Edition, Cengage Learning, 2014. ISBN-10: 1285051750

Reference Books:
1. Hisrich R D, Peters M P, "Entrepreneurship" 8th Edition, Tata McGraw-Hill, 2013. ISBN 1843769964
2. Mathew J Manimala, "Enterprenuership theory at cross roads: paradigms and praxis" 2nd Edition Dream tech, 2005. ISBN 81-297-0260-6
3. Rajeev Roy, "Entrepreneurship" 2nd Edition, Oxford University Press, 2011. ISBN 10: 0198072635
4. EDII "Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understand the basic concepts of entrepreneurship	L2
2. Understand the importance of motivation for entrepreneur	L2 & L3
3. Gain knowledge and skills needed to run a business successfully.	L3, L4 & L5
4. Learn the concepts of financing and accounting	L3
5. Understand the basic concepts of various supporting process	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A35KT.1	3	-	-	-	-	-	-	-	3	3	-	2	-	-	-
19A35KT.2	3	-	-	-	-	-	-	-	-	3	-	-	-	2	-
19A35KT.3	3	-	-	-	-	2	-	2	2	3	-	3	-	-	-
19A35KT.4	3	3	-	-	-	-	-	-	3	3	-	-	-	-	-
19A35KT.5	3	-	-	-	-	-	-	-	3	3	-	-	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Humanities and Sciences

Title of the Course	Constitution of India
Category	MC
Couse Code	19AC57T

Year	III B.Tech
Semester	II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	0

Course Objectives:
- To enable the student to understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of india and election commission of india.
- To understand the central and state relation financial and administrative

Unit 1   08
Introduction to Indian Constitution: Constitution' meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

Unit 2   08
Union Government and its Administration Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha, The Supreme Court and High Court: Powers and Functions

Unit 3   08
State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

Unit 4   08
Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation PachayatiRaj: Functions PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials - Importance of grass root democracy

Unit 5   08
Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissionerate State Election Commission:, Functions of Commissions for the welfare of SC/ST/OBC and women

Prescribed Text Books
1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.. New Delhi
2. Subash Kashyap, Indian Constitution, National Book Trust

Reference Books
1. J.A. Siwach, Dynamics of Indian Government & Politics
2. D.C. Gupta, Indian Government and Politics
3. M.V. Pylee, India's Constitution

Course Outcomes:
Student will be able to	Blooms Level of Learning
1. Understand historical background of the constitution making and its	L2

importance for building ademocratic India.

2. Understand the functioning of three wings of the government ie., executive, legislative and judiciary. L2

3. Understand the value of the fundamental rights and duties for becoming good citizen of India. L2

4. Analyze the decentralization of power between central, state and local self-government. L3

5. Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19AC57T.1	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-
19AC57T.2	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-
19AC57T.3	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-
19AC57T.4	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-
19AC57T.5	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Humanities and Sciences

Title of the Course   Universal Human Values - II
Category   HS
Couse Code   19AC53T

Year   III B. Tech
Semester   I Semester
Branch   CE, ME & CSE

Lecture Hours	Tutorial Hours	Practical	Credits
1	1	-	2

Course Objectives:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection
- Development of commitment and courage to act

Unit 1   Course Introduction - Need, Basic Guidelines, Content and Process for Value Education   6
- Purpose and motivation for the course, recapitulation from Universal Human Values-I
- Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and
- Experiential Validation- as the process for self-exploration
- Continuous Happiness and Prosperity- A look at basic Human Aspirations
- Right understanding, Relationship and Physical Facility- the basic requirements for
- fulfilment of aspirations of every human being with their correct priority
- Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
- Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innateacceptance for living with responsibility (living in relationship, harmony and co-existence)rather than as arbitrariness in choice based on liking-disliking.

Unit 2   Understanding Harmony in the Human Being - Harmony in Myself!   6
- Understanding human being as a co-existence of the sentient 'I' and the material'Body'
- Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
- Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
- Understanding the characteristics and activities of 'I' and harmony in 'I'
- Understanding the harmony of I with the Body: Sanyam and Health; correct
- appraisal of Physical needs, meaning of Prosperity in detail
- Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goodsavailable to me. Identifying from one's own life. Differentiate between prosperity andaccumulation. Discuss program for ensuring health vs dealing with disease.

Unit 3   Understanding Harmony in the Family and Society- Harmony in Human- Human   6
                          Relationship

- Understanding values in human-human relationship; meaning of Justice (nineuniversal values in relationships) and program for its fulfilment to ensure mutualhappiness; Trust and Respect as the foundational values of relationship
- Understanding the meaning of Trust; Difference between intention and competence
- Understanding the meaning of Respect, Difference between respect anddifferentiation; the other salient values in relationship
- Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensiveHuman Goals
- Visualizing a universal harmonious order in society- Undivided Society, UniversalOrder- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute asextended family, real life examples, teacher-student relationship, goal of education etc.Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples fromstudents' lives

Unit 4   Understanding Harmony in the Nature and Existence -Whole existence as Coexistence   6
- Understanding the harmony in the Nature
- Interconnectedness and mutual fulfilment among the four orders of nature recyclability
- and self-regulation in nature
- Understanding Existence as Co-existence of mutually interacting units in all pervasive space
- Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Unit 5   Implications of the above Holistic Understanding of Harmony on Professional Ethics   6
- Natural acceptance of human values
- Definitiveness of Ethical Human Conduct
- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
- Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for aboveproduction systems.
- Case studies of typical holistic technologies, management models and production systems
- Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations
- Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessionseg. To discuss the conduct as an engineer or scientist etc.

Prescribed Text Books
1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values andProfessional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course inHuman Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi,2019. ISBN 978-93-87034-53-2

Reference Books
1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).

4. Mohandas Karamchand Gandhi "The Story of My Experiments with Truth"
5. E. FSchumacher. "Small is Beautiful"
6. Slow is Beautiful –Cecile Andrews
7. J C Kumarappa "Economy of Permanence"
8. Pandit Sunderlal "Bharat Mein Angreji Raj"
9. Dharampal, "Rediscovering India"
10. Mohandas K. Gandhi, "Hind Swaraj or Indian Home Rule"
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland(English)
13. Gandhi - Romain Rolland (English)

Course Outcomes:

	Blooms Level of Learning
• Students are expected to become more aware of themselves, and their surroundings (family, society, nature)	L2
• They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.	L2
• They would have better critical ability.	L2
• They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).	L2
• It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19AC53T.1/63T.1												3
19AC53T.2/63T.2												3
19AC53T.3/63T.3												3
19AC53T.4/63T.4												3
19AC53T.5/63T.5												3

Assessment pattern for UHV-2

Assessment Pattern for Universal Human Values-II courses assessment is described hereunder.

UHV-2 course carries two credits. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation.

A student has to secure 40% marks out of 100 in the CIE and SEE together to qualify for the award of the degree. The distribution shall be 50 marks for continuous internal assessment and 50 marks for semester end examination.

Internal evaluation shall be conducted for the course during semester and shall be evaluated for 50 marks and distributions of marks as follows:

- Assessment by faculty mentor: 10 marks
- Self-assessment: 10 marks
- Assessment by peers: 10 marks
- Socially relevant project/Group Activities/Assignments: 20 marks

Semester End examination is done for 50 marks and is of 2 hours duration. The question paper shall be of subjective type with 5 questions, one question from each unit, with internal choice. All the questions carry equal marks of 10 each.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Humanities and Sciences

Title of the Course	General Aptitude
Category	HS
Couse Code	19AC51L

Year	III B. Tech
Semester	I Semester
Branch	CE, ME & CSE

Lecture Hours	Tutorial Hours	Practical	Credits
0	0	2	1

Course Objectives:

- To equip students with aptitude and reasoning skills in order to help them succeed in competitive exams.
- To help students improve their knowledge of quantitative and reasoning skills, which in turn helps them comprehend and solve various mathematical problems in professional life.
- To equip students with English verbal and reasoning skills in order to help them succeed in exams like GRE, TOEFL and help them to do well in placement drives.
- To help students improve their knowledge of grammar, vocabulary and reasoning skills pertain to English.

Quantitative Aptitude:
Number Systems - HCF and LCM - Averages - Problems on ages– Percentages - Profit and loss - Simplification - Ratio and Proportion - Time and Work - Time and Distance - Simple interest and Compound interest – Calendar - Clocks – Mensuration: Area, Volume and Surface Areas - Data Interpretation: Tabulation, Line Graphs, Bar Graphs, Pie charts.

Reasoning:
Directions - Blood Relations - Series and Sequences - Odd man out - Coding and Decoding - Data Sufficiency- Logical deductions.

English for Competitive Examinations
Synonyms – Antonyms – Analogy – Words often confused, One-word substitutions – Idioms and Phrases – Homonyms – Spellings
Reading comprehension – Cloze tests
Articles – Prepositions – Tenses – Voice – Error spotting and correcting – Sentence improvement.
Rearrangement of jumbled words and jumbled sentences – word pairs – sentence completion

Prescribed Textbooks:
1. R.S. Agarwal, Quantitative Aptitude, S. Chand Publishers, New Delhi, 2005.
2. R.S.Agarwal, Verbal and Non-Verbal Reasoning, S.Chand Publishers, New Delhi, 1998.
3. Hari Prasad, "Objective English for Competitive Exams", TMH
4. R. S. Agarwal, "Objective English", S. Chand Publishers

Reference Books
1. Shakuntala Devi, Puzzles to Puzzle you, Orient Paper Backs Publishers (OPB), New Delhi, 2005.
2. Arun Sharma, How to Prepare for Quantitative Aptitude, TMH Publishers, New Delhi, 2003.
3. Sharon Weiner-Green, IrnK.Wolf, Barron's GRE, Galgotia Publications, New Delhi, 2006.

4. Shakuntala Devi, More Puzzles, OPB, New Delhi, 2006.
5. Ravi Narula, Brain Teasers, Jaico Publishing House, New Delhi, 2005.
6. George J Summers, Puzzles and Teasers, Jaico Publishing House, Mumbai, 2005

Course Outcomes:
Student will be able to   Blooms Level of
                                                                                  Learning

- Demonstrate various principles involved in solving mathematical problems pertain to Quantitative functions.
- Decode information from charts and interpret their logical thinking in the aspects.
- interrelate English vocabulary with the knowledge of synonyms, antonyms, idiomatic expressions and, accuracy in English spelling
- apply knowledge of articles, prepositions, tenses and voice to correct errors or to improve sentences

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19AC51L/61L.1	3											3
19AC51L/61L.2	3											3
19AC51L/61L.3										3		3
19AC51L/61L.4										3		3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course   :   Thermal Engineering Lab
Category   :   PC
Course Code   :   19A351L
Year   :   III Year
Semester   :   I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
-	-	2	1

Course Objectives:

- To understand various engine components and demonstrate the ability the assemble / disassemble the IC engine
- To understand the concept of valves / ports actuating mechanism.
- To study the performance characteristics of I.C engine classification, Vapour compression Refrigeration system and reciprocating air compressor.
- To understand the energy dissipation and importance of heat balance sheet in IC engine.
- To understand the working principle of various boilers used for power generation

List of Experiments:
1. Disassembly/assembly of given engine.
2. Performance test on air compressor test rig.
3. Study load test on 4-stroke diesel engine
4. Load test on 4-stroke petrol engine
5. Load test on 2-stroke petrol engine.
6. (a) valve timing diagram (vtd)
   (b) port timing diagram (ptd)
7. Performance test on refrigeration test rig.
8. Heat balance sheet on 4-stroke diesel engine.
9. Heat balance sheet on 2-stroke petrol engine.
10. Study heat balance sheet on 4-stroke petrol engine.
11. Study morse test on 4-stroke petrol engine.
12. Motoring test on 2- stroke petrol engine.
13. Demonstration of boiler
14. (a) flash and fire point by clevel and (open) cup apparatus.
    (b) calorific value of fuel using bomb calorimeter.
15. Viscosity of the oil through saybolt viscometer apparatus.

Note: Any 12 experiments of the above 15 experiments are to be conducted.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. An ability to understand performance, heat balance sheet and morse test on I.C engines.	L3
2. Study Component of I.C engine.	L2
3. Identifying and study of the boiler models	L2
4. An ability to understand the working principle of Vapour compression Refrigeration system and evaluate the Coefficient of performance	L3

5. Determine the fluid properties. L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A351L.1	3	3	1	3	2	1	1	-	3	2	1	1	2	1	-
19A351L.2	2	-	2	3	3	-	-	-	-	-	-	-	2	2	-
19A351L.3	3	3	1	3	3	2	2	-	3	2	1	1	2	1	-
19A351L.4	3	3	3	3	-	1	2	-	-	-	-	2	1	2	-
19A351L.5	-	-	1	3	-	-	-	-	-	-	-	-	2	1	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course : Heat Transfer
Category : PC
Course Code : 19A361T
Year : III Year
Semester : II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
2	1	0	3

Course Objectives:
• To impart the basic laws of conduction, convection, radiation heat transfer and their applications.
• To provide knowledge about heat flow in various systems.
• To familiarize the convective heat transfer concepts.
• To understand the principles of phase change processes and radiation heat transfer.
• To make conversant about heat transfer in various heat exchangers.

Unit 1   Introduction to conduction heat transfer   6
Introduction: Modes and mechanisms of heat transfer – Basic laws of heat transfer –General applications of heat transfer. Conduction Heat Transfer: Fourier heat transfer 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.

Unit 2   One dimensional steady state & transient heat conduction   12
One Dimensional Steady State Heat Conduction: In homogeneous slabs, hollow cylinders and spheres – overall heat transfer coefficient – electrical analogy – Critical radius/thickness of insulation–System with internal heat generation (elementary treatment-Plane Wall-Uniform). Extended surface (fins) Heat Transfer – Long Fin, Fin with insulated tip and Short Fin, Application to error measurement of Temperature.
One Dimensional Transient Heat Conduction: Systems with negligible internal resistance – Significance of Biot and Fourier Numbers - Chart solutions of transient conduction systems- Problems on semi-infinite body.

Unit 3   Convective heat transfer   10
Convective Heat Transfer: Forced Convection: External Flows-Concepts of hydrodynamic and thermal boundary layer and use of empirical correlations for flow over-flat plates, cylinders. Internal Flows:-Division of internal flow through concepts of Hydrodynamic and Thermal entry lengths – Use of empirical relations for horizontal pipe flow, annular flow. Free Convection: -Development of Hydrodynamic and thermal boundary layer along a vertical plate – Use of empirical relations for plates and cylinders in horizontal and vertical orientation. Dimensional analysis Buckingham π Theorem- examples- Free & Forced convection.

Unit 4   Heat transfer with phase change & Radiation   12
Heat Transfer with Phase Change: Boiling- Pool boiling – Regimes, determination of heat transfer coefficient in Nucleate boiling, Critical Heat flux and Film boiling. Condensation: -Film wise and drop wise condensation.
Radiation 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.

Unit 5   Heat Exchangers   8

Heat Exchangers: Classification of heat exchangers – Overall heat transfer Coefficient and fouling factor – Concepts of LMTD and NTU methods - Problems using LMTD and NTU methods.

Prescribed Text Books:

1. R.C. Sachdeva, Fundamentals of Engg. Heat and Mass Transfer. New Age International, 5th Ed.2017, ISBN-13: 978-1781831038.
2. P.K.Nag, Heat Transfer. TMH, 3rd Ed. 2011, ISBN-13: 978-0070702530.
3. J.P.Holman, Heat Transfer. TMH, 10th Ed. 2010, ISBN-13: 978-0073529363.

Reference Books:

1. Incropera, Fundamentals of Heat and Mass transfer. Wiley India, 8th Ed,2017 ISBN: 978-1-119-35388-1.
2. M. Thirumaleswar, Fundamentals of Heat and Mass Transfer. Pearson Edu. 2006 ISBN 13: 9788177585193.
3. Arora and Domkunduwar/ A course in Heat and Mass transfer /Dhanpathrai and   sons.2007, ISBN-13: 978-8177000290
4. C.P.kothandaraman & S.Subramanyam, Heat and Mass transfer data hand book, New Age Publications, 2014, ISBN-13: 978-8122435955.

Course Outcomes:

Student will be able to   Blooms Level of Learning

1. Identify different modes of heat transfer.   L3
2. Apply the knowledge of conduction heat transfer for different phenomenon.   L3
3. Interpret forced and free convection heat transfer   L5
4. Determine the heat transfer rates in phase change process and radiation   L5
5. Measure the heat exchanger performance for a given application   L5

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A361T.1	3	3	-	-	-	-	1	-	-	-	-	2	1	-	-
19A361T.2	3	3	1	-	-	-	1	-	-	-	-	2	1	-	-
19A361T.3	3	3	2	-	-	-	1	-	-	-	-	2	1	-	-
19A361T.4	3	3	2	-	-	1	2	-	-	-	-	2	1	-	-
19A361T.5	3	3	3	-	-	1	1	-	-	-	-	2	1	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course   :   Engineering Metrology
Category   :   PC
Course Code   :   19A362T
Year   :   III Year
Semester   :   II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
2	1	0	3

Course Objectives:

- To understand the Limits and Fits, linear measurements and angular measurements, gauges, comparators, optical measuring methods, measurement of flatness and roughness of surface. And also learn about the screw thread and gear measuring methods.
- To ensure that the students can apply/analyze relevant quantitative models to solve real world problems.
- To make the students capable of appraising real life business situations and suggest solution alternatives as related to operations management techniques.

Unit 1   09
Systems of Limits and Fits: Introduction, Definitions, fits and their types – unilateral and bilateral tolerance system, Tolerance analysis .Hole and shaft basis systems – interchangeability and selective assembly. Indian Standard Institution system – International Standard system for plain and work. Limit Gauges: Plug, Ring, Snap, Gap, Taper, Profile and Position gauges. Taylor's principle. Design of Go and No Go gauges.

Unit 2   09
Linear Measurement: Length standard, line, ends & wavelength standards slip gauges – calibration of the slip gauges, Dial indicator, micrometers.
Measurement Of Angles And Tapers: Different methods – Bevel protractor –angle gauges – spirit levels – sine bar – Sine plate.
Flatness Measurement: straight edge– surface plate – optical flat and their uses, optical projector, interferometers and auto collimator.

Unit 3   08
Surface Roughness Measurement: Differences between surface roughness and surface waviness- Numerical assessment of surface finish – CLA, R.M.S Values – Ra , Rz values, Methods of measurement of surface finishprofilograph, Talysurf, BIS symbols for indication of surface finish.
Measurement Through Comparators: Comparators – Mechanical, Optical, Electrical, Electronic, Pneumatic comparators and their uses.

Unit 4   08
Screw Thread Measurement: Elements of measurement – errors in screw threads – measurement of effective diameter – one wire, two wire, three wire and best size methods, angle of thread and thread pitch- Tool maker's microscope.
Gear Measurement: Gear measuring instruments, Gear tooth profile measurement, Measurement of diameter, pitch, pressure angle and tooth thickness.

Unit 5   08
Inspection And Quality Control: Types of inspections – Difference between inspection & quality control. Acceptance sampling plan- single sampling and double sampling plans.

Coordinate Measuring Machines: Types of CMM and Applications of CMM.

Surface Engineering: Surface treatment processes and their characteristics and applications. (a) Overlay coatings (b) Thermal or mechanical modification of Surfaces.

Prescribed Text Books:

1. Measurement systems: Application and design, Doeblin Earnest. O. Adaptation by Manik and Dhanesh, TMH, 2012. ISBN 0-07-017338-9.
2. Engineering Metrology, R.K. Jain, Khanna Publishers, 20th edition, 2013. ISBN: 9788174091536 817409153X
3. Statistical Quality Control by EL Grantt, McGrawhil. 2001. ISBN-10 : 0078443547; ISBN-13 : 978-0078443541

Reference Books:

1. Engineering Metrology, Mahajan, DhanpatRai, 2nd edition, 2010. ISBN-10 : 8177000519
2. BIS standards on Limits & Fits
3. Fundamentals of Dimensional Metrology, Connie Dotson , 4e, Thomson. ISBN-10 : 0766820718
4. Metrology & Measurement by Anand K Bewoor, vinay A kulkarni, Mc Graw Hill, 2017. ISBN-10 : 9780070140004; ISBN-13 : 978-0070140004
5. Instrumentation, measurement &analysis, B.C.Nakra& KKChoudhary, TMH, 6th edition, 2011. ISBN 0070482969
6. Mechanical Measurements ,Beckwith, Marangoni, Linehard, PHI, PE. ISBN-10: 0201847655.
7. Alan s.morris "the essence of measurement", prentice hall of india, 2004. ISBN 1-86058-073.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understand the Limits, Fits and Tolerance.	L2
2. Apply the fundamentals of linear, angular and flatness measurement techniques for measuring the engineering components.	L3
3. Use the different types of comparators for measuring engineering components dimensions and surface roughness.	L4
4. Use the different types of instruments for measuring Screw thread elements and Gear tooth profile.	L4
5. Understand the concepts of inspection, quality control, types of acceptance sampling plan, CMM and its applications, surface treatment processes and surface coatings.	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A362T.1	3	3	3	1	3	1	-	-	-	1	-	-	-	2	-
19A362T.2	3	2	1	1	3	1	-	-	-	-	-	3	-	-	2
19A362T.3	3	2	1	1	3	1	-	-	-	-	-	3	-	-	2
19A362T.4	3	2	1	2	3	1	-	-	-	-	-	3	-	-	2
19A362T.5	3	2	2	1	1	1	-	-	-	-	-	3	-	-	1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course : Applied Thermodynamics-III
Category : PC
Course Code : 19A363T
Year : III Year
Semester : II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
2	1	0	3

Course Objectives:

- To understand the principle and operation of gas turbines and jet propulsions.
- To understand the Basic principles of refrigeration and the applications of air refrigeration and vapour compression refrigeration systems
- To understand the basic components and working of a different vapour absorption refrigeration systems and refrigerants used for different refrigeration systems.
- To familiarize the students in understanding the psychometric process and operation of various air conditioning systems
- To gain knowledge on different Air conditioning equipment and heat pump circuits.

Unit 1   Gas Turbines and Jet Propulsions   12
Gas Turbines: Simple gas turbine plant – Ideal cycle, essential components – parameters of performance – actual cycle – regeneration, inter cooling and reheating –Closed and Semi-closed cycles – merits and demerits.
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 engines – Turbo jet, Turbo prop, Pulse jet – Schematic Diagram. Introduction to Rocket propulsion.

Unit 2   Air Refrigeration And Vapour Compression Refrigeration   10
Introduction To Refrigeration: Necessity and applications – Unit of refrigeration and C.O.P. – Different refrigeration methods - Air Refrigeration- Ideal and Actual cycles, Open and Dense air systems – Refrigeration needs of Air craft's. Types. (Simple air cooling system and Boot Strap air cooling system- problems).
Vapour Compression Refrigeration: Basic cycle - working principle and essential components of the plant – COP – Representation η of cycle on T-S and P-h charts – Expander vs. Throttling, effect of sub cooling and super heating – cycle analysis – Actual cycle- Influence of various parameters on system performance – Construction and Use of P-h charts – numerical Problems.

Unit 3   Vapour Absorption Refrigeration System   08
Description of vapour absorption refrigeration system and working of (NH_3) – water system and Li Br –water (Two shell & Four shell) System -Calculation of max COP. Principle of operation of three Fluid absorption.
Refrigerants : Properties, Classification of Refrigerants, Ozone Depletion, Global Warming.

Unit 4   Introduction To Air Conditioning   11
Psychometric Properties & Processes – Characterization of Sensible and latent heat loads — Need for Ventilation, Consideration of Infiltrated air – Heat Load concepts: RSHF, GSHF- Problems. Requirements of human comfort and concept of Effective Temperature- Comfort chart –Comfort Air Conditioning-Summer, winter & year round air conditioning- simple problems.

Unit 5 :   Air Conditioning Equipment   07
Humidifiers – Dehumidifiers – air filters, fans and blowers.
Heat Pump:– Heat sources – different heat pump circuits.

Prescribed Text Books:
1. V. Ganesan, Gas Turbines, TMH Publishers, New Delhi. 2010. ISBN: 978-0-07-068192-7
2. A Course in Refrigeration and Air conditioning, SC Arora & Domkundwar, Dhanpat Rai & Co 2015. ISBN-13 : 978-1111644475
3. Refrigeration and Air Conditioning by R.K Rajput & S K Kataria & sons 3 rd Edition 2012. ISBN-10 : 9350142554.

Reference Books:
1. Gas dynamics and Jet Propulsion, S.L. Somasundaran, NAI Publishers, New Delhi. 1996. ISBN: 9788122409925.
2. A text book of Refrigeration and Air Conditioning, R.S.Khurmi & J.K.Gupta,S.Chand& Co 2015. ISBN: 9788121927819.
3. Refrigeration and Air Conditioning. P.L.Ballaney, Khanna Publcation 7th edition. ISBN: 9788174091369.
4. Refrigeration and Air Conditioning. R.C.Arora, PHI 2010. ISBN: ISBN-10 : 9788120339156.
5. Basic Refrigeration and Air Conditioning, Ananthanarayanan, TMH 3rd Edition. 2013. ISBN: 9781259062704
6. Refrigeration and Air Conditioning, Manohar Prasad, New Age, 3rd Ed,2011. ISBN: 9788122414295.

Data Hand Book:
- Refrigeration and air conditioning data book by Domkundwar & Domkundwar, Dhanpath Rai & co.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understand the basic cycle, working principle and classification, performance of gas turbines, Jet propulsion and rocket propulsion system.	L1
2. analyze the purpose and functioning of various components in the domestic refrigerator, analyzing the concept of sub-cooling and super heating in improving the COP.	L2
3. Analyze the basic cycle, working principle of various types of vapour absorption refrigeration systems, its calculation of COP And Refrigerant properties.	L2
4. Evaluate various Psychometric Properties, calculations of heat loads for various applications and selection of air-conditioning system based on climatic Seasons.	L3
5. Understand different heat pump circuits and Air conditioning equipment.	L1

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A363T.1	3	3	2	-	-	-	-	-	-	-	-	2	3	1	-
19A363T.2	3	3	2	-	-	-	-	-	-	-	-	2	3	1	-
19A363T.3	3	3	2	-	-	-	-	-	-	-	-	2	2	-	-
19A363T.4	3	3	2	-	-	-	-	-	-	-	-	2	2	1	-
19A363T.5	3	3	1	-	-	-	-	-	-	-	-	1	1	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course : Design of Machine Elements– II
Category : PC
Course Code : 19A364T
Year : III Year
Semester : II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:
- To learn the basic concepts of design of power transmission elements.
- To understand the design concepts of various types of springs, bearings and gears
- To help the students in applying design concepts of IC engine parts like Piston, cylinder, connecting rod and crank shaft.

Unit 1   Sliding Contact Bearings   08
Introduction, Types of Journal bearings – Lubrication – Petroff's equation, McKee's investigation, nomenclature, Bearing Modulus –bearing materials – journal bearing design.

Unit 2   Rolling Contact Bearings   08
Types of rolling contact bearings – Selection of bearing type, Static loading of ball & roller bearings Stribeck's equation, Dynamic load carrying capacity, equivalent bearing load, selection of bearing life, design for cyclic loads and speeds, bearing with a probability of survival other than 90%.

Unit 3   Engine Parts   10
Pistons, Forces acting on piston – Construction Design and proportions of piston - Thrust in connecting rod – stress due to whipping action on Connecting rod ends – Cranks and Crank shafts, strength and proportions of center cranks.

Unit 4   Mechanical Springs   10
Mechanical Springs: Introduction- types of Springs– Stress and deflection of closed under axial pull and axial couple. Springs for fatigue loading - Leaf springs.
Power Transmissions Systems: Design of Flat belt drives & V-belt drives.

Unit 5   Spur & Helical Gears   10
Spur Gears: Introduction, classification of gears, terminology of spur gears Force analysis, beam strength of gear tooth, effective load on gear tooth, Design analysis of spur gears – Estimation of module and face width, check for plastic deformation. Check for dynamic and wear considerations for spur gears
Helical Gears: Introduction, terminology of helical gears, Force analysis, beam strength of gear tooth, effective load on gear tooth, Design analysis of helical gears – Estimation of module and face width, check for plastic deformation. Check for dynamic and wear considerations for helical gears.

Prescribed Text Books:
1. V.B.Bhandari, Machine Design. TMH, 2016. ISBN-10 : 9789339221126; ISBN-13 : 978-9339221126
2. R.S. Khurmi & J.S.Gupta, Machine Design. S.Chand Publications. 2005. ISBN: 9788121925372

Reference Books:
1. JE Shigley, Mech. Engg. Design. McGraw-Hill Education; 10 edition. 2014. ISBN-10 : 9780073398204

2. T. Krishna Rao, Design of Machine Elements-II. I.K. International. 2010. ISBN: 9380026633, 9789380026633
3. T.V. Sundaramoorthy & N.Shanmugam, Machine Design. Khanna Publishers, 2003. ISBN: 978-81-7409-190-1
4. Kanniah, Machine Design. Scitech Publishers. 2003. ISBN: 8188429104, 9788188429103
5. Data Books: (i) P.S.G. College of Technology (ii) Balaveer Swamy and Mahadevan

Tables/Codes: Design data books are to be supplied in examination

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Design journal bearings, ball bearings and roller bearings and to know the advantages of rolling contact bearings against sliding contact bearings.	L6
2. Know various forces acting on I C engine parts and failure criteria to be adopted for various parts.	L2
3. Know Helical springs for two wheel vehicle and laminated springs for trucks.	L2
4. Design belt drives for different input conditions.	L6
5. Design spur and helical gears for different input conditions.	L6

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A364T.1	3	3	3	3	-	-	3	-	-	-	2	-	-	-	-
19A364T.2	3	3	3	3	-	-	3	-	-	-	2	-	-	-	-
19A364T.3	3	3	3	3	-	-	3	-	-	-	-	-	-	-	-
19A364T.4	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
19A364T.5	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course   :   Turbo machinery
Category   :   PE
Course Code   :   19A36AT
Year   :   III Year
Semester   :   II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:
- To impart the basic knowledge of turbo machinery
- To familiarize various power absorbing devices and its key parameters.
- To understand the flow characteristics of Centrifugal compressors
- To make conversant with the flow characteristics of Axial compressors
- To provide preliminary design on turbo machines.

Unit 1   Principles   8
Energy transfer between fluid and rotor, classification of fluid machinery, dimensionless parameters, specific speed, applications, stage velocity triangles, work and efficiency for compressors and turbines.

Unit 2   Centrifugal Fans and Blowers   8
Types, stage and design parameters, flow analysis in impeller blades, volute and diffusers, losses, characteristics curves and selection, fan drives and fan noise.

Unit 3   Centrifugal Compressor   9
Construction details, types, impeller flow losses, slip factor, diffuser analysis, losses and performance curves.

Unit 4   Axial Flow Compressor   9
Stage velocity triangles, enthalpy-entropy diagrams, stage losses and efficiency, work done factor, simple stage design problems and performance characteristics.

Unit 5   Axial and Radial Flow Turbines   14
Stage velocity diagrams, reaction stages, losses and coefficients blade design principles, testing and performance characteristics.

Prescribed Text Books:
1. Turbines, Compressors & Fans, S. M. Yahya, Tata McGraw Hill & Co. Ltd., 4th edition, 2010. ISBN 13: 9780070707023
2. V. Kadambi and Manohar Prasad, "An Introduction to Energy Conversion, Volume III, Turbo machinery", New Age International Publishers, reprint 2008. ISBN-13: 978-1781830086
3. Fundamentals of Turbo machinery: William W Perg, John Wiley & Sons, Inc. 2008. ISBN: 9780470124222

Reference Books:
1. S. L.Dixon, "Fluid Mechanics & Thermodynamics of Turbo machines", Elsevier (2005). ISBN-13: 978-0124159549

2. Fundamentals of turbo machinery, B.K.Venkanna PHI, New Delhi 2009. ISBN 13: 9788120337756

3. M. S. Govindgouda and A. M.Nagaraj, "A Text Book of Turbomachines", M. M. Publications, 10th Ed, 2014.

ISBN-135551234003189.
4. Earl Logan, Jr. Publisher: CRC Press; 2 edition (1 May 2003) ISBN-13: 978-0824709952
5. D. G. Shepherd, "Principals of Turbo machines" , the Macmillan Company (1964). ISBN-13: 978-0024096609

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Classify Turbo machines and discuss the importance of dimensionless numbers in turbo machines.	L2
2. Explain various losses and calculate the stage & design parameters in centrifugal fans and blowers.	L2
3. Assess air angle, pressure ratio and power required in centrifugal compressor.	L5
4. Determine stage losses, stage efficiency and pressure ratio in axial flow compressor.	L5
5. Evaluate the flow coefficient, loading coefficient and stage parameters in axial & radial flow turbines.	L5

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A36AT.1	3	3	1	-	-	1	1	-	-	-	-	2	1	-	-
19A36AT.2	3	3	1	-	-	1	1	-	-	-	-	2	1	-	-
19A36AT.3	3	3	2	-	-	1	1	-	-	-	-	2	1	-	-
19A36AT.4	3	3	2	-	-	1	1	-	-	-	-	2	1	-	-
19A36AT.5	3	3	2	-	-	1	1	-	-	-	-	2	1	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course   :   Tribology
Category   :   PE
Course Code   :   19A36BT
Year   :   III Year
Semester   :   II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:
- To understand the lubricant principles, types of lubricants and their properties
- To understand the mechanisms of friction and wear in materials
- To analyse the friction force and power loss in hydrodynamic and hydrostatic lubrication.
- To understand the preparation of bearing materials.

Unit 1   Introduction to Tribology: 08
Properties of oils and equation of flow: Viscosity, Newton's Law of viscosity, Hagen-Poiseuille Law, Flow between parallel stationary planes, viscosity measuring apparatus. Purpose of lubrication, properties and characteristics of lubricants, types of lubricants (oils, greases, solid lubricants), lubrication systems, Lubricant Additives.

Unit 2   Friction and Wear   08
Friction: Material properties influencing friction, laws of friction, causes/theories of friction, Types of friction, Elastic and Visco-elastic effects in friction, effects of friction.
Wear:Causes/sources of wear, types of wear (adhesive, abrasive, corrosive, erosive, fretting), wear of polymers, wear of ceramic materials, effects of wear, steps for wear prevention/resistance, Wear measurement. Effects of speed, temperature and pressure. Tribological measures, Material selection.

Unit 3   Hydrodynamic Lubrication and Mechanism of Pressure Development in an Oil Film   07
Hydrodynamic Lubrication::Friction forces and power loss in lightly loaded bearing, Petroff's law, Tower's experiments, idealized full journal bearings.
Mechanism of Pressure Development in an Oil Film: Reynold's investigations, Reynold's equation in two dimensions. Partial journal bearings, end leakages in journal bearing, numerical problems.

Unit 4   Slider / Pad Bearing with a Fixed and Pivoted Shoe   07
Pressure distribution, Load carrying capacity, coefficient of friction, frictional resistance in a pivoted shoe bearing, influence of end leakage, numerical examples.

Unit 5   Hydrostatic Lubrication and Bearing Materials   07
Hydrostatic Lubrication: Introduction to hydrostatic lubrication, hydrostatic step bearings, load carrying capacity and oil flow through the hydrostatic step bearing.
Bearing Materials: Commonly used bearings materials, properties of typical bearing materials.

Prescribed Text Books:
1. Lubrication of Bearings – Theoretical Principles and Design by Redzimovskay E I., Oxford press Company 2014. ISBN: 978-0073398204.
2. Principles and Applications of Tribology by Moore, Pergamaon press 2013. ISBN: 9781483157283.

Reference Books:
1. Fundamentals of Tribology by Basu S K., Sengupta A N., Ahuja B. B., , PHI 2006. ISBN: 9788120327238.
2. Introduction to Tribology Bearings by Mujumdar B. C., S. Chand company pvt. Ltd 2008. ISBN: 9788121929875

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Realize and describe the lubrication principles and mechanisms.	L3
2. Recognize the different friction and wear mechanism in tribological components.	L2,L4
3. Analyze the friction surfaces and power losses in hydrodynamic lubrication.	L3
4. Compute load carrying capacity in light and heavy loaded journal bearings.	L3
5. Compute load carrying capacity in hydrostatic step bearing and Identify the appropriate material for bearings based on the application.	L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A36BT.1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
19A36BT.2	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
19A36BT.3	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
19A36BT.4	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
19A36BT.5	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course	:	Instrumentation and control systems
Category	:	PE
Course Code	:	19A36CT
Year	:	III Year
Semester	:	II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:
- To understand generalized measurement system and its functional elements.
- To know about Sensors, Transducers and their working principles.
- To gain knowledge about the instruments, working principles of pressure, flow and temperature.
- To get knowledge on Measurement and their working of Force, Torque, Acceleration, Vibrations.
- To know about application of strain gauges for different measurements.
- To gain knowledge about Control Systems, Mathematical Models and Transfer Function.

Unit 1   Measurement And Instrumentation   09
Measurement, measurement methods, generalized measurement system and its functional elements, classification of instruments, error and its classification, static and dynamic characteristics, Sensors and Transducers: Introduction, transducers classification and description, transducer sensitivity, variable resistance transducers, variable inductance transducers, capacitive transducers, LVDT, piezo electric and photo electric transducers.

Unit 2   Measurement Of Pressure, Flow And Temperature   11
Pressure measurement terms, measurements of low pressure gauges such as McLeod gauge, thermal conductivity gauge, Ionization gauge, measurement of high pressure such as Bourdon gauge and bellows, resistance gauge, Classification of flow measurement techniques, special flow meters such as Turbine flow meter, Magnetic flow meter, Hot wire anemometer, Ultrasonic flow meter. Temperature measurement instruments, thermocouples, resistance thermometers and thermistors, radiation and optical Pyrometers.

Unit 3   Measurement of Force, Torque, Acceleration, Vibrations   09
Basic force measurement methods such as elastic load cells, elastic strain gauge load cells, hydraulic and pneumatic load cells, Torque measurement, different types of torsion meters, piezo electric accelerometer, Strain gauge accelerometer. Mechanical type vibration instruments - Seismic instruments as an accelerometer and vibrometer, Calibration of vibration pickups.

Unit 4   Strain Gauges And Measurement   09
Strain measuring techniques, requirement of strain gauges, resistance strain gauges, strain gauges alloys and material, bonded and unbonded strain gauges, bonding techniques, temperature compensation in strain gauges.

Unit 5   Control Systems, Mathematical Models And transfer Function   10
Introduction, examples of control systems, classification of control systems, open loop and closed loop control systems, control system terminology, servomechanism. Physical system and mathematical models, mechanical systems, thermal systems, electrical systems, hydraulic and pneumatic systems, linear control system, transfer function, block diagram and its reduction process, signal flow graphs, mason's rule.

Prescribed Text Books:

1. Beckwith and Buck, Mechanical Measurements. Narosa Publication.2012. ISBN 9332518521
2. S. Ghosh, Control Systems – Theory & Applications. Pearson Education, New Delhi, 2014. ISBN 9781299446427
3. Er.R.K. Rajput, Mechanical Measurements and Instrumentation,S.K.Kataria,New Delhi 2019. ISBN 978-93-5014-285-1

Reference Books:

1. D.S. Kumar, Mechanical Measurements and Control. Metropolitan Books, New Delhi, 2015. ISBN 8120002728
2. B.S.Manke, Linear Control Systems. Khanna Publishers, New Delhi, 2009. ISBN 9788174093103
3. Nagarathan and Gopal, Control System Engineering, Narosa Publishers. 2020. ISBN 9781781833070
4. Naresh K. Sinha, Control Systems, NAI Publishers, New Delhi, 2013. ISBN 9788122433531

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understand the working of generalized measurement system and its functional elements.	L2
2. Apply the working principles of various instruments used for measuring pressure, flow and temperature.	L3
3. Apply the working principle of various instruments used for measuring force, torque, acceleration, vibrations.	L3
4. Analyze about measurement methods of strain gauges.	L4
5. Evaluate a control system to meet a specified performance using analytic, graphical, empirical and computer methods.	L5

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A36CT.1	3	-	-	-	-	3	1	3	3	3	-	-	2	-	-
19A36CT.2	3	-	-	-	-	3	-	3	3	3	-	-	2	-	-
19A36CT.3	3	-	-	-	-	3	-	3	3	3	-	-	2	-	-
19A36CT.4	3	-	-	-	-	3	-	3	3	3	-	-	2	-	-
19A36CT.5	3	1	-	-	-	3	-	3	3	3	-	-	2	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course : Additive Manufacturing
Category : PE
Course Code : 19A36DT
Year : III Year
Semester : II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:

- To understand the fundamentals of various Additive Manufacturing Technologies for application to various industrial needs.
- To convert part file into STL format.
- To understand the method of manufacturing of liquid based, powder based and solid based techniques.
- To understand the manufacturing procedure of a prototype using FDM technique.
- To understand the 3-D printing specifications, process and uses.

Unit 1 Introduction 09
Prototyping fundamentals, Historical development, Advantages of AMT, Commonly used terms, process chain, 3D modelling, Data Conversion, and transmission, Checking and preparing, Building, Post processing, RP data formats, Classification of AMT process, Applications to various fields

Unit 2 Liquid based systems 10
Stereo lithography apparatus (SLA): Models and specifications, process, working principle, photopolymers, photo polymerization, layering technology, laser and laser scanning, applications, advantages and disadvantages, case studies. Solid ground curing (SGC): Models and specifications, process, working, principle, applications, advantages and disadvantages, case studies.

Unit 3 Solid based systems 09
Laminated object manufacturing (LOM): Models and specifications, Process, Working principle, Applications, Advantages and disadvantages, Case studies. Fused Deposition Modelling (FDM): Models and specifications, Process, Working principle, Applications, Advantages and disadvantages, Case studies, practical demonstration

Unit 4 Powder Based Systems 09
Selective laser sintering (SLS): Models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

Unit 5 Three dimensional printing (3DP) 08
Models and specification, process, working principle, applications, advantages and disadvantages, case studies.

Prescribed Text Books:
1. Chua C.K., Leong K.F. and LIM C.S Rapid prototyping: Principles an Applications, World Scientific publications, 3rdEd., 2010. ISBN-10 : 9812778985; ISBN-13 : 978-9812778987
2. D.T. Pham and S.S. Dimov, "Rapid Manufacturing", Springer, 2001. ISBN-13: 978-1-4471-0703-3

Reference Books:
1. Terry Wohlers, " Wholers Report 2000", Wohlers Associates, 2000. ISBN 978-0-9913332-6-4

2. Paul F. Jacobs, " Rapid Prototyping and Manufacturing"–, ASME Press, 1996. ISBN. 0-9640233-3-4
3. Ian Gibson, Davin Rosen, Brent Stucker "Additive Manufacturing Technologies, Springer, 2nd Ed, 2014. ISBN 978-1-4939-2113-3

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understand the fundamentals of Additive Manufacturing Technologies for engineering applications.	L2
2. Understand the methodology to manufacture the products using SLA and SGC technologies and study their applications, advantages and case studies	L2
3. Understand the methodology to manufacture the products using LOM and FDM technologies and study their applications, advantages and case studies	L2
4. Understand the methodology to manufacture the products using SLS technologies and study their applications, advantages and case studies.	L2
5. Understand the 3D Printing technologies and study their applications, advantages and case studies.	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A36DT.1	3	-	3	3	-	3	3	-	-	-	-	-	-	-	-
19A36DT.2	3	3	-	3	-	3	3	2	-	-	-	-	-	-	2
19A36DT.3	3	3	3	-	-	3	3	-	-	-	-	1	-	1	-
19A36DT.4	3	3	3	3	-	3	3	-	-	-	-	-	-	1	-
19A36DT.5	3	-	3	-	-	3	3	2	-	-	1	-	-	-	2

Title of the Course: Basic Civil Engineering
Category   :   OE
Course Code   :   19A16GT
Year   :   III B. Tech
Semester   :   II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives:
- To give an understanding to the students of the vast breadth and numerous areas of engagement available in the overall field of Civil Engineering.
- To motivate the student to pursue a career in one of the many areas of Civil Engineering with deep interest and keenness.
- To expose the students to the various avenues available for doing creative and innovative work in this field by showcasing the many monuments and inspiring projects of public utility.

Unit 1 :   08
Basic Understanding: What is Civil Engineering/ Infrastructure? Basics of Engineering and Civil Engineering; Broad disciplines of Civil Engineering; Importance of Civil Engineering, Possible scopes for a career.
History of Civil engineering: Early constructions and developments over time; Ancient monuments & Modern marvels; Development of various materials of construction and methods of construction; Works of Eminent civil engineers

Unit 2 :   10
Overview of National Planning for Construction and Infrastructure Development; Position
of construction industry vis-à-vis other industries, five year plan outlays for construction; current budgets for infrastructure works;
Fundamentals of Building Materials: Stones, bricks, mortars, Plain, Reinforced & Pre-stressed Concrete, Construction Chemicals; Structural Steel, High Tensile Steel, Carbon Composites; Plastics in Construction; 3D printing; Recycling of Construction & Demolition wastes.

Unit 3 :   10
Environmental Engineering & Sustainability: Water treatment systems; Effluent treatment systems; Solid waste management; Sustainability in Construction;
Geotechnical Engineering: Basics of soil mechanics, rock mechanics and geology; various types of foundations; basics of rock mechanics & tunnelling.

Unit 4 :   08
Hydraulics &Water Resources Engineering: Fundamentals of fluid flow, basics of water supply systems; Underground Structures; Underground Structures Multi-purpose reservoir projects.
Surveying & Geomatics: Traditional surveying techniques, Total Stations, Development of Digital Terrain Models; GPS, LIDAR;

Unit 5 :   08
Computational Methods, IT, IoT in Civil Engineering: Typical software used in CivilEngineering- Finite Element Method, Computational Fluid Dynamics; Computational Geotechnical Methods; highway design (MX), Building Information Modelling; Highlighting typical available software systems (STAAD, ETAB & AUTOCAD)

Prescribed Text Books:
1.   Chudley, R., Greeno (2006), 'Building Construction Handbook' (6th ed.),R. Butterworth-Heinemann

2. Hydraulics and Fluid Mechanics, P M Modi and S M Seth, Standard Book House
3. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.
4. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering(Civil and Environmental Engineering) by V.N.S. Murthy
5. Building Planning & Drawing by Dr N. Kumaraswamy and A.KameswaraRao, Charitor Publications
6. Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011.

Reference Text books:

1. Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc.corresponding to materials used for Civil Engineering applications
2. An Introduction to Geotechnical Engineering, by Holtz R.D. and Kovacs, W.D., Prentice Hall, NJ
3. K Subramanya, Water Resources Engineering through Objective Questions, Tata Mc-GrawHill.
4. Introduction to Environmental Engineering and Science by Gilbert Masters, Prentice Hall,New Jersey.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Identifying the various areas available to pursue and specialize within the overall field of Civil Engineering.	L3
2. Showcasing the many monuments, heritage structures, nationally important infrastructure, and impressive projects to serve as sources of inspiration.	L1
3. Highlighting the depth of engagement possible within each of these areas.	L3
4. Providing a foundation for the student to launch off upon an inspired academic pursuit into this branch of engineering.	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A16GT.1	-	-	-	-	-	3	-	-	2	-	-	1	1	2	-
19A16GT.2	-	-	-	-	-	3	-	-	2	-	-	1	1	2	-
19A16GT.3	-	-	-	-	-	3	-	-	2	-	-	1	1	2	-
19A16GT.4	-	-	-	-	-	3	-	-	2	-	-	1	1	2	-

Title of the Course: Water Resources and Conservation
Category   :   OE
Course Code   :   19A16HT
Year   :   III B. Tech
Semester   :   II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives:

• To impart knowledge about the planning and management of water resources.
• To introduce the concepts of watershed management, integrated water resources management, environmental interaction of water resources and policies/framework related to water resources.
• To enable the students to understand the different components of water resources and water conservation techniques.

Unit 1 :   08
Historical profile on world water resources development; Global water resources, Hydrologic cycle, Watershed zoning, Interrelation of water resources with other natural resources and the environment, Water quantity and water budget, Water allocation and water scheduling; Water resources availability and demand.

Unit 2 :   10
Hydrologic Processes – evaporation, transpiration and precipitation; Water quality parameters, Water pollution – causes, effects and measures; Rainfall-Runoff analysis, Floods measurement, frequency analysis, design of peak flood and routing, Reservoir operation and design.

Unit 3 :   10
Water resource planning – concept, preliminary study, feasibility study, detailed planning, Design of water distribution system, Irrigation scheduling and techniques;
Water use sectors – Domestic, Industries and Agriculture, Sustainable water resources development, Integrated Water Resources Management (IWRM), Socio-economic aspects of water resources management, Rainwater Harvesting Watershed management.

Unit 4 :   09
Global Efforts on Water conservation, Think Globally Act Locally on water resources, Local water organizations, National Water Policy, World water organizations - WUGs, WUAs, UN, WWP, WWC, etc. Environmental discourse on dam Construction.

Unit 5 :   08
Water conservation Techniques: Protection of Water from Pollution, Redistribution of Water, Rational Use of Groundwater, Renovation of Traditional Water Sources, Use of Modern Irrigation Methods, Increasing Forest Cover, Change in Crop Pattern, Flood Management, Conserving Water in Industries, Conservation of water by Municipal authorities, Use rainwater effectively, Make effective use of soil water reserves, Take measures to avoid run off, Avoid wasting water through evaporation, Reduce water losses through drainage, Plan your irrigation, Contour Farming& Contour Ploughing

Prescribed Text Books:

1. Global Water Partnership (GWP), Integrated Water Resources Management, Background Papers No. 4, Technical Advisory Committee (TAC)..
2. Water Resources Systems Planning and Management, Vol. 51 by Jain, S.K. and V.P. Singh, Elsevier Science

3. Hierarchical Analyses of Water Resources Systems: Modeling and Optimization of Largescale systems by Haimes, McGraw-Hill, New York.
4. Water Resources Systems Planning and Management by Loucks D.P. and van Beek E., UNESCO Publishing, The Netherlands.

Reference Text books:

1. Water Resources Systems Planning and Analysis by Loucks, D.P., J.R. Stedinger, and D.A. Haith, Prentice-Hall, N.J.
2. Hydro systems Engineering and Management by Mays, L.W. and K. Tung, McGraw-Hill Inc., New York.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Identify different problems related to water resources planning, management and development.	L3
2. Describe problems like water balance, rainfall-runoff analysis, water distribution networks, flood routing, irrigation scheduling, water pollution and other water related concerns	L2
3. Apply principles and guidelines to solve above mentioned problems.	L4
4. Understand different water conservation techniques, in order to save water for future	L2

CO-PO Mapping:

OE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A16HT.1	-	-	-	-	-	2	3	-	2	-	-	-	1	-	3
19A16HT.2	-	-	-	-	-	2	3	-	2	-	-	-	1	-	3
19A16HT.3	-	-	-	-	-	2	3	-	2	-	-	-	1	-	3
19A16HT.4	-	-	-	-	-	2	3	-	2	-	-	-	-	-	3

Title of the Course : Energy Management and Conservation
Category   :   OE2
Course Code   :   19A26GT
Year   :   III B. Tech
Semester   :   II Semester (Common to CE, ME & CSE)

Lecture Hours	Tutorial Hours	Practical	Credits
3	1	-	4

Course objective:
- To impart basic knowledge to the students about current energy scenario, energy conservation and management.
- To inculcate among the students systematic knowledge and skill about assessing the energy efficiency and energy management.

Unit-I   Principles of energy management   08
Organizing an energy management program – Initiating and managing an energy management program - Planning - Leading – Controlling – Promoting – Monitoring and reporting.

Unit-II   Electrical energy management   08
Energy efficient motors – Power factor improvement – Lighting and lighting system control – Energy saving opportunities.
Qualities and functions of energy managers – Qualities and functions of an energy manager – questionnaire -Check list for top management.

Unit-III   Energy Scenario   0 6
Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy sector reforms, energy and environment, energy conservation and its importance, energy efficiency and its need, restructuring of the energy supply sector, energy strategy for the future, air pollution, climate change.

Unit-IV   Energy Conservation:
Principles of Energy Conservation. Energy Conservation Act 2001 and its feature, Electricity Act -2003 and features, The Energy Conservation (Amendment)Act,2010 and its importance. Prominent organizations at Centre and state level responsible for its implementation. Energy Consumption pattern, Resource availability, Energy pricing, Energy Security.

Unit-V   Basics of Energy, pricing and its uses in buildings
Electricity tariff, load management and maximum demand control, power factor
Improvement, selection & location of capacitors.
Estimation of Energy use in buildings: Estimation of Energy use in a building, Heat gain and Thermal Performance of building envelope- steady and Non-Steady heat transfer through the glazed window and the wall-standard for thermal performance of building envelope, Evaluation of the overall Thermal Transfer.

Text Books :
1. "Energy Management" - W.R.Murphy&G.MckeyButterworths.
2. "Energy Management Hand Book" - W.C.Turner, John Wiley and Sons.
3. "Energy Management Principles" – Craig B Smith – Pergamon press
4. "Energy Conservation" -   Pa ulO'Callagan - Pergamon press.
5. S.C. Tripathy, "Utilization of Electrical Energy and Conservation", McGraw Hill, 1991

Department of Mechanical Engineering

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. To understand the Principles and organization of energy management	L2 &L4
2. To acquaintance with electrical energy management like energy saving opportunities and Power factor improvement.	L3
3. Analyze the current energy scenario and its importance in energy conservation	L4
4. Understand the concepts of Energy conservation and its features.	L2
5. Understand the estimation of Energy use in buildings.	L2

COs-POs-PSOs Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19A26GT.1	3	3	-	-	-	2	3	-	-	-	-	3
19A26GT.2	3	3	-	-	-	3	3	-	-	-	-	3
19A26GT.3	3	3	-	-	-	2	2	2	-	-	-	3
19A26GT.4	3	3	-	-	-	2	2	2	-	-	-	2
19A26GT.5	3	3	-	-	-	2	2	2	-	-	-	2

Title of the course: Fuzzy Logic and Neural Network

Category   : OE

Course code   : 19A26HT

Year   : III B.Tech

Semester   : II Semester

Lecture Hours	Tutorial Hours	Practical Hours	Credits
3	-	-	3

Course Objectives

- To understand the fundamental concepts of Artificial Neural network
- To Understand the concepts of different types Neural network architectures and training algorithms
- To understand the concepts of classical sets Fuzzy sets
- To understand the concepts Fuzzy logic controllers
- To gain knowledge in neuro- fuzzy control and its applications in power systems

Unit 1:   Introduction to Artificial Neural Networks   12

Introduction, Biological Neuron, Biological Artificial Neuron model , Integrate-and-Fire Neuron Model, Spiking Neuron Model, Characteristics of neural networks , Historical developments, Neural network architectures, McCulloch-Pitts Model, Types of neuron activation functions, Learning methods(supervised, unsupervised, Reinforcement), Applications of Neural Networks.

Unit-2:   Single layer and multi layer feed forward neural networks   12

Perceptron Models: Discrete, Continuous (concepts only), Perceptron Convergence   theorem, Limitations of the Perceptron Model, Applications, ADALINE, MADALINE, Back Propagation   Network, BP Learning Rule, Input Layer, Hidden Layer and output Layer computations, Radial Basis function network, Hetero associative memory neural and Auto associative memory net, applications.

Unit-3   Classical and Fuzzy sets   08

Introduction to classical sets, Fuzzy sets – Properties, Operations and Relations, Membership, Uncertainty, Fuzzy Relations, Cardinalities and Membership Functions.

Unit-4   Fuzzy Logic system and components   10

Fuzzification, Membership Value assignment, Development of Rule Base, Defuzzification to crisp sets, Defuzzification methods

Unit 5   Neural network and fuzzy logic applications to Power system   10

ANN Based Short Term Load Forecasting, Load Flow Studies, Fault diagnosis and Fuzzy Logic based Unit Commitment and load frequency control.

Text Books:

1. S.N.Sivanadam, S.N.Deepa *Principles of Soft Computing Techniques* , Wiley India publication.
2. JacekM.Zurada *Introduction to Artificial Neural Systems*, Jaico Publishing House, 1997.

Reference Books:

1. N. Yadaiah and S. BapiRaju, *Neural and Fuzzy Systems*: *Foundation, Architectures and Applications*, Pearson Education
2. James A Freeman and Davis S kapura, *Neural Networks* ,Pearson, 2002
3. Brok Kosko, *Neural Networks and Fuzzy Logic System* , , PHI Publications
4. Rajasekharan and Rai, *Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications* - PHI Publication.

Department of Mechanical Engineering

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

1. Able to analyze and form Neural Networks For Different Problems
2. Able to Get the knowledge of Different Types of Neural Networks
3. Understand fuzzy concepts and fuzzy logic components
4. Able to apply Neural Networks for Electrical Systems.
5. Able to apply Fuzzy Logic for Electrical Systems

COs-POs-PSOs Mapping

Course Outcomes	Program Outcomes														PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	1	2
19A26HT .1	1	1	1	1	1	-	-	-	1	1	1	1	1	1	1	1
19A26HT .2	2	3	2	2	3	-	-	-	2	2	2	2	2	2	2	2
19A26HT .3	-	2	-	-	-	-	-	-	-	-	2	-	-	-	-	2
19A26HT .4	-	-	-	3	-	-	-	-	-	-	-	3	-	-	2	-
19A26HT .5	2	3	2	2	2	-	-	-	2	2	2	2	2	2	2	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course   :   Electronic Circuits and its Applications
Category   :   OE
Course Code   :   19A46GT
Year   :   III B. Tech
Semester   :   II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives: The course aims to provide the student with the ability

- To analyze and design the transistor and feedback amplifiers.
- To understand and analyze the concepts of oscillators, linear and nonlinear wave shaping circuits.

Unit 1 :   SMALL SIGNAL ANALYSIS OF AMPLIFIERS   14

Introduction to h-parameter model, Small Signal model of BJT, Analysis of CB, CE and CC configurations using h-parameters – simplified hybrid model – miller's theorem – dual of miller's theorem. Analysis ofCascaded Transistor Amplifiers- RC Coupled amplifier, Frequency response of RC Coupled, Direct coupled and Transformer coupled amplifiers.

Unit 2 :   FEEDBACK AMPLIFIERS   14

Concept of Feedback, Classification of feedback amplifiers, Transfer Gain with feedback, General characteristics of negative feedback amplifiers. Voltage series, voltage shunt, current series, and current shunt feedback amplifiers with discrete components (Topologies).

Unit 3 :   OSCILLATORS   10

Condition for oscillations. Oscillator Types, Frequency and amplitude stability of oscillators, LC oscillators-Hartley and Colpitts oscillators, RC-phase shift and Wien bridge oscillators, Crystal Oscillators

Unit 4 :   LARGE SIGNAL AMPLIFIERS   09

Classifications, Class A power Amplifiers- Direct coupledand Transformer Coupled, Class B power Amplifiers- Push-pull and Complementary Symmetry-Transistor power dissipation, Power and Efficiency calculations.

Unit 5 :   LINEAR AND NON LINEAR WAVE SHAPING   12

High pass & low pass RC circuits, their response for sinusoidal, step, pulse, square, ramp and Exponential inputs. Diode and Transistor clippers and clampers, clamping circuit theorem.

Prescribed Text Books:
1. J. Millman and Christos C. Halkias- "Integrated Electronics", McGraw-Hill, 1972.
2. Robert T. Paynter- "Introductory Electronic Devices and Circuits", Pearson Education, 7th Edition.
3. J. Millman and H. Taub, "Pulse, Digital and Switching Waveforms", McGraw-Hill, second edition, 2007.

Reference Text books:
1. Robert L. Boylestad and Louis Nashelsky - "Electronic Devices and Circuits Theory", Pearson/Prentice Hall, 9th Edition, 2006.
2. Donald A. Neumann- "Electronic Circuit Analysis and Design", McGraw Hill.
3. Anand Kumar, "Pulse and Digital Circuits", PHI, 2005.Second Edition.

Department of Mechanical Engineering

Course Outcomes:

Upon completion of the course, student can	Blooms Level of Learning
1. Analyze the single stage amplifiers using h-parameter model at low frequencies.	L4
2. Understand the feedback amplifiers and oscillators.	L2
3. Analyze the concepts of large signal amplifiers.	L4
4. Design and analyze linear and nonlinear wave shaping circuits.	L6

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A46GT.1	3	3	2	3	3	1	-	-	2	-	-	-	2	3	-
19A46GT.2	1	3	3	2	2	-	-	-	2	-	-	-	3	-	-
19A46GT.3	3	3	3	2	2	1	-	-	2	-	-	-	2	3	-
19A46GT.4	2	2	2	-	-	-	-	-	2	-	-	-	2	3	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course	:	Basics of Communication Systems
Category	:	OE
Course Code	:	19A46HT
Year	:	III B. Tech
Semester	:	II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives: This course will able to

- Design simple systems for generating and demodulating AM, DSB, SSB and VSB signals.
- Understand the concepts in Angle modulation for the design of communication systems.
- Design simple systems for generating and demodulating frequency modulated signals.
- Learn the concepts of random process and various types of noise.
- Analyze pulse modulation and sampling techniques.

Unit 1 :   AMPLITUDE MODULATION   10

AMPLITUDE MODULATION: Introduction, Amplitude Modulation: Time & Frequency – Domain description, Switching modulator, Envelop detector. DOUBLE SIDE BAND-SUPPRESSED CARRIER MODULATION: Time and Frequency – Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing. SINGLE SIDE–BAND AND VESTIGIAL SIDEBAND METHODS OF MODULATION: SSB Modulation, VSB Modulation, Frequency Translation, Frequency- Division Multiplexing, Theme Example: VSB Transmission of Analog and Digital Television

Unit 2 :   ANGLE MODULATION   10

ANGLE MODULATION: Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, Phase–Locked Loop: Nonlinear model of PLL, Linear model of PLL, Nonlinear Effects in FM Systems. The Super heterodyne Receiver

Unit 3 :   RANDOM VARIABLES & PROCESS   10

RANDOM VARIABLES & PROCESS: Introduction, Probability, Conditional Probability, Random variables, Several Random Variables. Statistical Averages: Function of a random variable, Moments, Random Processes, Mean, Correlation and Covariance function: Properties of autocorrelation function, Cross–correlation functions. NOISE: Shot Noise, Thermal noise, White Noise, Noise Equivalent Bandwidth

Unit 4 :   NOISE IN ANALOG MODULATION   10

NOISE IN ANALOG MODULATION: Introduction, Receiver Model, Noise in DSB-SC receivers, Noise in AM receivers, Threshold effect, Noise in FM receivers, Capture effect, FM threshold effect, FM threshold reduction, Pre-emphasis and De-emphasis in FM

Unit 5 :   DIGITAL REPRESENTATION OF ANALOG SIGNALS   10

DIGITAL REPRESENTATION OF ANALOG SIGNALS: Introduction, Why Digitize Analog Sources?, The Sampling process, Pulse Amplitude Modulation, Time Division Multiplexing, Pulse-Position Modulation, Generation of PPM Waves, Detection of PPM Waves, The Quantization Process, Quantization Noise, Pulse– Code Modulation: Sampling, Quantization, Encoding, Regeneration, Decoding, Filtering, Multiplexing , Application to Vocoder

Prescribed Text Books:

1. **Communication Systems**, Simon Haykins&Moher, 5th Edition, John Willey, India Pvt. Ltd, 2010,

Reference Text books:

1. Modern Digital and Analog Communication Systems, B. P. Lathi, Oxford University Press., 4th edition.
2. An Introduction to Analog and Digital Communication, Simon Haykins, John Wiley India Pvt. Ltd., 2008,
3. Principles of Communication Systems, H.Taub&D.L.Schilling, TMH, 2011.
4. Communication Systems, Harold P.E, Stern Samy and A.Mahmond, Pearson Edition, 2004.
5. Communication Systems: Analog and Digital, R.P.Singh and S.Sapre: TMH 2nd edition, 2007.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Determine the performance of analog modulation schemes in time and frequency domains.	L4
2. Determine the performance of systems for generation and detection of modulated analog signals.	L4
3. Characterize analog signals in time domain as random processes and in frequency domain using Fourier transforms.	L3
4. Characterize the influence of channel on analog modulated signals	L3
5. Understand the characteristics of pulse amplitude modulation, pulse position modulation and pulse code modulation systems.	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
19A46HT.1	3	1	-	-	-	1	-	-	-	3	-	2	3	2
19A46HT.2	3	3	1	-	-	1	-	-	-	2	-	2	3	2
19A46HT.3	2	3	-	1	-	2	-	-	-	2	-	2	3	2
19A46HT.4	2	1	3	-	-	2	-	-	-	2	-	2	3	2
19A46HT.5	3	3	1	-	-	1	-	-	-	2	-	2	3	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course	:	Artificial Intelligence
Category	:	OE
Course Code	:	19A56IT
Year	:	III Year
Semester	:	II Semester (Offered to CE & ME)

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives: This course will
1. To comprehend the building blocks of AI in terms of intelligent agents.
2. To understand the main approaches of artificial intelligence such as heuristic search, game search and logical inference.
3. To know how decision theory and planning is processed on the agents.
4. To verify the different types of objects in uncertain world for an agent
5. To identify the solution in uncertain knowledge with reasoning.

Unit 1 :   Introduction to Artificial Intelligence   9
   Introduction to AI, History of AI, Emergence of Intelligent Agents, Intelligent Agents: PEAS- Representation for an Agent, Types of Agents, Types of Agent Environments, Concept of Rational Agent, Structure of Intelligent agents, Defining the Problem as a State Space Search, Problem Characteristics.

Unit 2 :   Problem Solving   12
Solving problems by searching, Problem Formulation, Uninformed Search Techniques- DFS, BFS, Iterative Deepening, Comparing Different Techniques, Informed search methods – heuristic Functions, Hill Climbing, Simulated Annealing, A*, Performance Evaluation. Constrained Satisfaction Problems: Constraint Satisfaction Problems like – map Coloring, Crypt Arithmetic, Backtracking for CSP, Local Search.

Unit 3 :   Knowledge and Reasoning   9
   A knowledge Based Agent, Introduction To Logic, Propositional Logic, Reasoning in Propositional logic, First Order Logic: Syntax and Semantics, Extensions and Notational Variation, Inference in First Order Logic, Unification, Forward and Backward chaining, Resolution.

Unit 4 :   Knowledge Engineering and Planning   11
   Knowledge Engineering: Ontology, Categories and Objects, Mental Events and Objects.
   Planning: Planning problem, Planning with State Space Search, Partial Order Planning, Hierarchical Planning, Conditional Planning.

Unit 5 :   Uncertain Knowledge and Reasoning   10
   Uncertain Knowledge and Reasoning: Uncertainty, Acting Under Uncertainty, Basic Probability Notation, The Axioms of Probability, Inference Using Full Joint Distributions, Independence, Bayes' Rule and Its Use, Belief Networks, Simple Inference in Belief Networks, Fuzzy Logic.

Prescribed Text Books:
1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 2nd Edition, Pearson Publication.
2. Rich, E. and Knight, K., "Artificial Intelligence", Tata McGraw-Hill.

Reference Books:
1. George Lugar, "AI-Structures and Strategies for Complex Problem Solving", 4/e, 2002, Pearson Education.
2. Robert J. Schalkolf, Artificial Intelligence: an Engineering approach, McGraw Hill, 1990.
3. Patrick H. Winston, Artificial Intelligence, 3rd edition, Pearson.

Course Outcomes:
Student will be able to   Blooms Level of Learning
1. Understand the importance of artificial Intelligence in real world environment   L2

2. Apply the artificial intelligence algorithms for problem solving   L3
3. Analyze the various reasoning and knowledge representation techniques   L4
4. Solve the problems using classification and planning techniques   L3
5. Apply knowledge and reasoning techniques in uncertain environment for   L3
   obtaining solution

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19A56IT.1	3	3	-	-	-	3	-	-	3	2	-	2
19A56IT.2	3	3	3	3	-	3	2	-	3	-	-	2
19A56IT.3	3	3	3	3	-	3	-	-	3	2	-	-
19A56IT.4	3	3	3	3	1	3	2	-	3	-	-	-
19A56IT.5	3	3	3	3	-	3	-	-	3	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course : Cyber Security
Category : OE
Course Code : 19A56JT
Year : III B. Tech
Semester : II Semester (Common to CE & ME)

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives: This course will able to
- Remember Cyber Security architecture principles
- Compare different classes of attacks
- Understand about cybercrime with mobile and wireless devices
- Apply tools and methods used in cybercrime
- Understand about cyber security and social media marketing.

Unit 1 :   INTRODUCTION: 10
Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals?, Classifications of Cybercrimes, The Legal Perspectives, Indian Perspectives, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens
Cyber offenses: Introduction of Criminal Planning and Criminal Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector Cloud Computing.

Unit 2 :   CYBERCRIME MOBILE AND WIRELESS DEVICES: 10
Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

Unit 3 :   TOOLS AND METHODS USED IN CYBERCRIME: 9
Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Phishing and Identity Theft: Introduction, Phishing, Identity Theft(ID Theft)

Unit 4 :   CYBERCRIMES AND CYBER SECURITY: 9
Why Do We Need Cyber laws: The Indian Context, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signatures and the Indian IT Act, Information Security Planning and Governance, Information Security Policy Standards, Practices, The information Security Blueprint, Security education, Training and awareness program, Continuing Strategies.

Unit 5 :   UNDERSTANDING COMPUTER FORENSICS: 10
Introduction, Historical Background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber forensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites: The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Antiforensics

Prescribed Text Books:
1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole, SunitBelapure, Wiley.
2. Principles of Information Security, MichealE.Whitman and Herbert J.Mattord, Cengage Learning.

Reference Text Books:
   1. Information Security, Mark Rhodes, Ousley, MGH.
   2. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press

Web References:
1.https://www.tutorialspoint.com/fundamentals_of_science_and_technology/cyber_crime_and_cyber_security.htm

Course Outcomes
Student will be able to	Blooms Level of Learning
1. Remember Cyber Security architecture principles	L1
2. Compare different classes of attacks	L2
3. Understand about cybercrime with mobile and wireless devices	L2
4. Apply tools and methods used in cybercrime	L3
5. Understand about cyber security and social media marketing	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19A56JT.1	3	3	3	-	3	-	-	3	-	-	3	-
19A56JT.2	-	3	-	3	-	3	-	-	3	-	-	3
19A56JT.3	3	-	-	3	-	-	3	3	-	3	-	3
19A56JT.4	3	3	3	-	3	-	-	-	-	-	3	3
19A56JT.5	-	-	3	3	3	-	-	-	3	-	3	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Humanities and Sciences

Title of the Course   Professional Communication Skills Lab
Category   BS
Couse Code   19AC62L

Year   III Year
Semester   II Semester
Branch   CE, ME, CSE

Lecture Hours	Tutorial Hours	Practical	Credits
-	-	3	1.5

Résumé Preparation – structure, formats and styles – planning - defining career objective - projecting one's strengths and skills - creative self-marketing–sample resumes - cover letter

Interview Skills- concept and process - pre-interview planning – preparation - body language - answering strategies – frequently asked questions

Group Discussion –communicating views and opinions – discussing – intervening – agreeing and disagreeing – asking for and giving clarification - substantiating - providing solution on any given topic across a cross-section of individuals - modulation of voice and clarity - body language – case study

Oral Presentations (Individual& Team) – collection of data from various sources –planning, preparation and practice – attention-gathering strategies - transitions – handling questions from audience

Listening Comprehension – listening for understanding - responding relevantly

Learning Resources: AECS Lab Manual prepared by Dept of HS, AITS Rajampet

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. express himself/herself fluently in social and professional contexts	L4
2. demonstrate effective presentation skills	L4
3. face interviews confidently	L3
4. participate in meetings effectively	L4
5. listen actively for better understanding	L4

CO-PO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
19AC62L. 1	-	-	-	-	-	-	-	-	-	3	-	3	-	-	-
19AC62L. 2	-	-	-	-	-	-	-	-	-	3	-	3	-	-	-
19AC62L. 3	-	-	-	-	-	-	-	-	-	3	-	3	-	-	-
19AC62L. 4	-	-	-	-	-	-	-	-	-	3	-	3	-	-	-
19AC62L. 5	-	-	-	-	-	-	-	-	-	3	-	3	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course	:	Heat Transfer Lab
Category	:	PC
Course Code	:	19A361L
Year	:	III Year
Semester	:	II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
-	-	2	1.5

Course Objectives:
- To acquire Knowledge of the principle of mode of heat transfer
- To design and applications of heat exchanger
- To gain knowledge transient heat conduction and heat pipe
- To provide practical knowledge to determine heat transfer coefficient in boiling and   condensation

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

Note: 1. Any 12 experiments of the above 14 experiments are to be conducted.
        2. Heat Transfer data Books and Steam Tables data books are permitted in the examinations.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Determine thermal conductivity in metal bars, insulating powder, lagged pipe and composite slab.	L3
2. Evaluate the fin efficiency and fin effectiveness.	L1,L3
3. Evaluate convective het transfer coefficient by performing experiments in free and forced convections.	L3
4. Determine Stefan Boltzmann constant and emissivity of gray body.	L2
5. Demonstrate practical understanding on unsteady state heat conduction, Heat pipe and Two phase flow.	L1
6. Determine convective het transfer coefficient in drop and film wise condensation	L2
7. Determine Critical heat flux for pool boiling	L2
8. Analyze the performance of heat exchanger	L1, L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A361L.1	3	2	2	2	-	-	-	-	-	-	-	-	-	2	-
19A361L.2	3	3	3	2	-	-	-	-	-	-	-	-	-	2	-
19A361L.3	3	3	3	2	-	-	-	-	-	-	-	-	-	2	-
19A361L.4	3	3	2	-	-	-	-	-	-	-	-	-	-	2	-
19A361L.5	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
19A361L.6	3	3	2	-	-	-	-	-	-	-	-	-	-	2	
19A361L.7	3	2	2	-	-	-	-	-	-	-	-	-	2	-	-
19A361L.8	3	3	2	2	-	-	-	-	-	-	-	-	-	-	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course   :   Metrology & Machine Tools Lab
Category   :   PC
Course Code   :   19A365L
Year   :   III Year
Semester   :   II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
-	-	2	1

Course Objectives:
6. To learn the Step turning and taper turning and thread cutting on lathe machine
7. To learn the operations of Drilling, Tapping, Shaping, Slotting and milling.
8. To demonstrate the usage of metrology lab equipment.
9. To know the working principles of different instruments
10. To learn the measurement of the Angle and taper s by Bevel protractor, Sine bar, etc

List of Experiments: Machine Tools Lab
1. Demonstration of construction & operations of general purpose machines: Lathe, Drilling machine, Milling machine, Shaper, Planning machine, Slotting machine, Cylindrical Grinder, Surface grinder and Tool & cutter grinder.
2. Job on Step turning and taper turning on lathe machine
3. Job on Thread cutting and knurling on -lathe machine.
4. Job on Drilling and Tapping
5. Job on Shaping and Planning
6. Job on Slotting
7. Job on Milling Job on Cylindrical Surface Grinding
8. Job on Grinding of Tool angles.

List of Experiments: Metrology Lab
1. Measurement of lengths, heights, diameters by Vernier calipers, micrometers etc.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear teeth, Vernier calipers and checking the chordal addendum and chordal height of spur gear.
4. Alignment test on the lathe.
5. Alignment test on milling machine.
6. Study of Tool makers microscope and its application
7. Angle and taper measurements by Bevel protractor, Sine bars, etc.
8. Use of spirit level in finding the flatness of surface plate.
9. Thread measurement by two wire/ three wire method.
10. Surface roughness measurement by Talysurf instrument.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Demonstrate knowledge of different machine tools used in machine shop.	L4
2. Perform step, taper turning, knurling and threading operations on lathe.	L3
3. Have Practical exposure on Flat Surface machining, Shaping, Slotting, Milling and grinding operations.	L3
4. Apply the procedures to measure length, width, depth, bore diameters,	L5

external tapers, tool angles, and surface roughness by using different instruments.

5. Measure the angle and taper using Bevel protractor and Sine bar   L4
6. Conduct different machine alignment tests   L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A365L.1	3	3	3	3	3	-	-	-	3	-	-	-	3	-	-
19A365L.2	3	2	-	-	2	-	-	-	2	-	-	-	1	2	3
19A365L.3	3	3	-	-	3	-	-	-	3	-	-	-	1	2	3
19A365L.4	3	3	-	3	3	-	-	-	3	-	-	-	3	1	-
19A365L.5	3	-	-	-	3	-	-	-	3	-	-	-	1	3	-
19A365L.6	3	-	-	-	3	-	-	-	3	-	-	-	1	2	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course : CAD/CAM
Category : PC
Course Code : 19A371T
Year : IV Year
Semester : I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
2	-	-	2

Course Objectives:
- To understand the basic concepts of CAD/CAM and Transformations.
- To understand the different geometric modeling techniques like solid modeling, surface modeling, feature based modeling etc. and to visualize how the components look like before its manufacturing or fabrication
- To develop NC and CNC programs to manufacture industrial Components.
- To understand the importance of Group Technology and Flexible Manufacturing System
- To understand the elements of an automated manufacturing environment

Unit 1   Introduction To Computer Graphics   10
Introduction: Introduction to CAD and CAM- Elements of CAD-Computers in Industrial Engineering-Product Cycle-CAD/CAM Hardware-Basic Structure of CPU-Input and Output Devices-Display Devices (CRT and DVST)-Raster Scan Graphics Coordinate System-Representation of Line and Circles, Database Structure for Graphics Modeling-Transformation -2D and 3D

Unit 2   Curve Representation   10
Geometric Modeling-Classification of wireframe entities, Curve representation methods, Parametric representation of analytic curves: line, circle, arc, conics, Parametric representation of synthetic curves: Hermite cubic curve, Bezier curve, B-Spleen curve-Representation of surface modelling, -Hermite bicubic surface patch-Bezier and B-spline Surfaces, Solid modelling techniques, CSG and B-rep.

Unit 3   Numerical Control   08
NC, NC modes, NC elements, NC machine tools, structure of CNC machine tools, features of Machining center, turning center, CNC Part Programming: fundamentals, manual part programming methods, Computer Aided Part Programming.

Unit 4   Group Technology And Flexible Manufacturing System   10
Group Technology: Part family, coding and classification, production flow analysis, advantages and limitations, Computer Aided Processes Planning, Retrieval type and Generative type.
Flexible Manufacturing System: Introduction to FMS – Material Handling System – Computer Control Systems – Human Labor in Manufacturing system – Applications – Advantages and Limitations

Unit 5 :   Computer Integrated Production Planning And Computer Aided Quality Control   10
Computer Aided Quality Control (CAQC): Capacity planning, shop floor control, MRP-I, MRP-II, CIMS benefits, JIT approach. Terminology in quality control, the computer in QC, contact inspection methods, non-contact inspection methods-optical and non-optical, and computer aided testing, integration of CAQC with CAD/CAM.

Prescribed Text Books:
1. P N Rao, CAD/CAM – Principle and Applications. 2010. ISBN: 9780070681934

2. A Zimmer & P Groover, CAD/CAM. PE,PHI. ISBN: 9788177584165.
3. RadhaKrishnan and Subramaniah, CAD/CAM/CIM. New Age. 2008. ISBN: 8122422365, 9788122422368.

Reference Books:

1. Groover, P.E, Automation, Production systems & Computer integrated Manufacturing. ISBN-10: 0132393212.
2. Farid Amirouche, Principles of Computer Aided Design and Manufacturing. Pearson Hall. 2004. ISBN, 0130646318, 9780130646316.
3. CSP Rao, A text book of CAD/CAM, Hitech Publ. (2002) ISBN 81-7764-294-4

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Identify the importance of CAD/CAM in modern manufacturing systems and explain the hardware used for CAD/CAM systems.	L1&L2
2. Able to understand and develop the Mathematical representations of curves.	L2
3. Find the difference between conventional and NC techniques and to develop a simple program.	L3
4. Describe the use of GT and CAPP for the product development.	L3
5. To identify the various elements involved in the computer aided manufacturing system	L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A371T.1	2	-	-	-	-	-	-	-	3	-	-	-	-	-	-
19A371T.2	2	2	3	2	-	-	-	-	3	-	-	-	3	-	-
19A371T.3	-	-	3	2	1	-	-	-	3	-	-	-	3	-	-
19A371T.4	-	2	3	-	-	-	-	-	3	-	-	-	3	-	-
19A371T.5	-	-	3	-	-	-	-	-	3	-	-	-	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course	:	Operations Research
Category	:	PC
Course Code	:	19A372T
Year	:	IV B.Tech
Semester	:	I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
2	1	0	3

Course Objectives:

- To enable the students to the nature and scope of various decision making situations within business contexts, understand and apply operations research techniques to industrial applications.
- To learn the fundamental techniques of Operations Research and to choose a suitable OR technique to solve problem.

Unit 1   10

Development – Definition– Characteristics and Phases – Types of operation and Research models– applications.
Linear Programming Problem Formulation – Graphical solution – Simplex method –Artificial variables techniques - Two–phase method, Big-M method – Duality Principle.

Unit 2   10

Transportation Problem: Formulation – Optimal solution, unbalanced transportation problem –Degeneracy.
Assignment Problem – Formulation – Optimal solution - Variants of Assignment Problem-Travelling Salesman problem

Unit 3   10

Replacement Models: Introduction – Replacement of items that deteriorate with time – with change in money value - without change in money value – Replacement of items that fail completely, group replacement.
Theory Of Games: Introduction – Minimax - Maximin – Criterion and optimal strategy – Solution of games with saddle points – Rectangular games without saddle points – 2 X 2 games – m X 2, 2 X n & m x n games -Graphical method, Dominance principle.

Unit 4   08

Waiting Lines: Introduction – Single Channel – Poisson arrivals – exponential service times – with infinite queue length models.
Simulation: Definition – Types of simulation models – phases of simulation– applications of simulation – Queuing problems – Advantages and Disadvantages – Simulation Languages.

Unit 5   10

Inventory: Introduction – Single item – Deterministic models – Purchase inventory models with one price break and multiple price breaks.
Dynamic Programming: Introduction – Bellman's Principle of optimality – Applications of dynamic programming-shortest path problem – linear programming problem.

Prescribed Text Books:
1.   PS Gupta, DS Hira, Operations Research, S Chand Publications, 10th Edition, 2016, ISBN-13978-8121902816.

2. S.D. Sharma, Operations Research, Kedarnath and Ramnath Publications, 2012, ISBN-135551234001596

Reference Books:

1. Taha, Introduction to Operations Research. PHI, 10 th edition, 2016, ISBN-13978-0134444017

2. R. Panneerselvam, Operations Research. PHI Publ, 2nd edition, 2004, ISBN: 9788120319233

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Create mathematical models of the real life situations and capable of obtaining best solution using Graphical Method and Simplex Method, Big M method and the student must be able to implement the theory of duality for simplifying the solution procedure for certain LPPs.	L3
2. Solve the special cases of LPP such as Transportation, Assignment and Travelling Salesmen problems.	L3
3. Find optimal replacement period of a machine or group of parts.	L3
4. Have knowledge of choosing the best strategy out of the available strategies which is an essential skill for any business manager to successfully face the competition.	L3
5. Understand and will apply the fundamentals of waiting lines in real life situations.	L3
6. Simulate queuing models	L3
7. Have aware of applying Dynamic Programming technique to solve the complex problems by breaking them into a series of sub- problems.	L3
8. Understand and will apply the fundamentals of inventory in real life situations.	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A372T.1	3	3	-	1	-	-	-	-	-	-	-	-	2	-	-
19A372T.2	3	3	2	-	-	-	3	-	-	-	-	-	2	-	-
19A372T.3	3	3	2	-	-	-	3	-	-	-	-	-	2	-	-
19A372T.4	3	3		-	-	-	3	-	-	-	-	-	2	-	-
19A372T.5	3	3	2	-	-	1	3	-	-	-	-	-	2	-	-
19A372T.6	3	3	-	-	-	1	3	-	-	-	-	-	2	-	-
19A372T.7	3	3	-	-	-	-	3	-	-	-	-	-	2	-	-
19A372T.8	3	3	-	-	1	-	3	-	-	-	-	-	2	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course : R&AC
Category : PE
Course Code : 19A37AT
Year : IV Year
Semester : I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:

- To equip the students to understand vapour compression refrigeration cycle, vapor absorption refrigeration cycle and air conditioning equipment.
- To enable the students to design summer and winter air conditioning systems.
- To enable the students to understand the psychometric properties and their calculation using the psychometric charts and tables to design the comfort air conditioning system suitable to particular application.

Unit 1   Introduction To Refrigeration   09
Necessity and applications – Unit of refrigeration and C.O.P. – Different refrigeration methods - Air Refrigeration: Ideal and Actual cycles, Open and Dense air systems –- problems – Refrigeration needs of Aircrafts.

Unit 2   Vapour Compression Refrigeration   10
Basic cycle - working principle and essential components of the plant – COP – Representation η of cycle on T-S and P-h charts – Expander vs. Throttling, effect of sub cooling and super heating – cycle analysis – Actual cycle Influence of various parameters on system performance – Construction and Use of P-h charts – numerical Problems. Refrigerants – Desirable Properties – Common refrigerants used – Nomenclature.

Unit 3   Vapor Absorption Refrigeration System   09
Description and working of NH3 – water system and Li Br –water (Two shell & Four shell) System -Calculation of max COP. Principle of operation of three Fluid absorption systems. Steam Jet Refrigeration System – Principle and operation of (i) Thermoelectric refrigerator (ii) Vortex tube or Hilsch tube.

Unit 4   Introduction To Air Conditioning   10
Psychometric Properties & Processes – Characterization of Sensible and latent heat loads –– Need for Ventilation, Consideration of Infiltrated air – Heat Load concepts: 152 | P a g e RSHF, GSHF- Problems. Requirements of human comfort and concept of Effective Temperature- Comfort chart –Comfort Air Conditioning- Summer, winter & year round air conditioning- simple problems.

Unit 5 :   Air Conditioning Equipment   08
humidifiers – dehumidifiers – air filters, fans and blowers. Heat Pump – Heat sources – different heat pump circuits.

Prescribed Text Books:
1. CP Arora, Refrigeration and Air Conditioning. TMH, 2008, 3rd Ed. ISBN-10 : 0070083908
2. SC Arora & Domkundwar, A Course in Refrigeration and Air conditioning. Dhanpatrai. ISBN : 4567152026

Reference Books:
1. Manohar Prasad, Refrigeration and Air conditioning, Wiley Eastern Ltd., 2011. ISBN 10: 8122435033 / ISBN 13: 9788122435030

2. Arora, C. P. (2012), Refrigeration and Air Conditioning, 3rd edition, McGraw-Hill Education, 2012. ISBN 10: 9351340163 ISBN 13: 9789351340164
3. Dossat, Principles of Refrigeration. Pearson Edu., 4th Ed. ISBN-13: 9780132333719
4. P.L.Ballaney, Refrigeration and Air Conditioning. Khanna Publ. 1998.ISBN: 978-81-7409-136-9
5. R.C.Arora, Refrigeration and Air Conditioning. PHI, 2010. ISBN 10: 8120339150 / ISBN 13: 9788120339156
6. Eugene Silberstein , Refrigeration and Air Conditioning Technology, 7th Edition (International), Delmar publications, 2012. ISBN-10 : 1111644470; ISBN-13 : 978-1111644475
7. G H Hundy, A R Trott, T C Welch, Refrigeration, Air Conditioning and Heat Pumps, 5th edition, (International), Butterworth-Heinemann Publications, 2016. ISBN: 9780081006665, 0081006667

Tables/Codes: Thermal Engineering Data Book containing Refrigerant and Psychrometric property Tables and charts

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understand the basics of vapour compression refrigeration system	L2
2. Analyze different components of vapour compression refrigeration system and able to design the vapour compression refrigeration system for the given application by selecting the proper refrigerant.	L4
3. Analyze the vapour absorption refrigeration system.	L4
4. Estimate the different loads of air conditioning system and calculation of psychometric properties using psychometric chart and equations.	L3
5. Select the proper air conditioning equipment by knowing their purpose and characteristics.	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A37AT.1	3	2	1	-	1	1	-	-	-	-	-	-	-	-	-
19A37AT.2	3	3	2	1	2	1	2	-	1	-	-	2	-	1	-
19A37AT.3	3	3	2	1	2	1	2	-	1	-	-	2	-	1	1
19A37AT.4	3	3	2	2	2	1	2	-	1	-	-	2	-	1	1
19A37AT.5	3	2	1	-	1	1	-	-	-	-	-	-	-	1	1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course   :   Finite Element Methods
Category   :   PE
Course Code   :   19A37BT
Year   :   IV Year
Semester   :   I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:

- To enable the students to understand fundamentals of finite element analysis.
- To learn the principles involved in the discretization of domain with various elements, polynomial interpolation and assembly of global arrays.
- To learn the application of FEM in various structural and non structural problems by incorporating boundary conditions.

Unit 1   14

Introduction to finite element methods for solving field problems, Stress and equilibrium, Boundary conditions, Strain-Displacement relations, Stress- strain relations for 2D and 3D Elastic problems, Potential energy and equilibrium.
One dimensional problem: Finite element modeling coordinates and shape functions. Assembly of global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions, solution for displacements, reaction, stresses, temperature effects.

Unit 2   08

Analysis of trusses: Stiffness Matrix for plane truss element. Stress Calculations and Problems.
Analysis of beams: Element Stiffness Matrix for two noded, two degrees of freedom per node beam element and simple problems.

Unit 3   08

Two dimensional problems: Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions. Estimation of load Vector, Stresses. Finite element modeling of Axi-symmetric solids subjected to axi-symmetric loading with triangular elements.

Unit 4   12

Iso-Parametric Formulation: Concepts, sub parametric, super parametric elements, 2 dimensional 4 nodediso-parametric elements, and numerical integration.
Steady state heat transfer analysis: One dimensional analysis of slab and fin, two dimensional analysis of thin plate. Analysis of a uniform shaft subjected to torsion.

Unit 5   06

Dynamic analysis: Formulation of finite element model, element –mass matrices, evaluation of Eigen values and Eigen vectors for a stepped bar and Beam.

Prescribed Text Books:

1. Introduction to Finite elements in Engineering- Tirupathi.R. Chandrupatla and Ashok D. Belegundu-Pearson Education India -4th Edition 2015- ISBN-978-9332551824
2. Finite Element Analysis- Dr. S Senthil, R Paneerdhass – Lakshmi Publications-5th Edition 2013-ISBN-978-

9383103317

3. Finite Element Analysis in Engineering- S.Md. Jalaludeen- Anuradha Publications- 2016-ISBN-978-8184722376

Reference Books:
1. J N Reddy, An introduction to the Finite Element Method, McGraw – Hill, New York, 1993. ISBN-10 : 0072466855
2. R D Cook, D S Malkus and M E Plesha, Concepts and Applications of Finite Element Analysis, 3rd Edition, John Wiley, New York, 1989. ISBN 13: 9780471503194
3. K J Bathe, Finite Element Procedures in Engineering Analysis, Prentice-Hall, Englewood Cliffs, 1982. ISBN 978-0-9790049-5-7

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Identify mathematical model to solve common engineering problems by applying the finite element method and able to solve one dimensional problems like bars	L3, L4
2. Derive element matrices to find stresses in beams and trusses	L3
3. Formulate FE characteristic equations for two dimensional elements and analyze plain stress, plain strain, axi-symmetric problems.	L4
4. Formulate FE equations for iso-paramteric elements and heat transfer problems	L4
5. Solve dynamic problems where the effect of mass matters during the analysis	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A37BT.1	3	3	1	1	3	-	-	-	1	1	-	1	3	-	2
19A37BT.2	3	3	-	-	-	-	-	-	-	-	-	-	2	-	2
19A37BT.3	3	3	1	1	3	-	-	-	-	-	-	-	-	-	3
19A37BT.4	3	3	-	-	-	-	-	-	-	-	-	-	-	2	-
19A37BT.5	3	3	-	-	-	-	-	-	-	-	-	-	3	2	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course	:	Unconventional machining process
Category	:	PE
Course Code	:	19A37CT
Year	:	IV Year
Semester	:	I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:

- 1. The main objective of this subject is to provide students with an understanding of the latest technologies being used in manufacturing industries as part of modernization of industries.
- 2. The students shall also understand and appreciate the importance of basic principles of Manufacturing Systems and also they will know about the differences between conventional and un-conventional machining process with the help of various advanced manufacturing techniques like USM, AJM, ECM, CM, EDM, PAM, EBM & LSB.

Unit 1   Introduction   10

Need for non-traditional machining methods- Classification of modern machining processes – considerations in process selection. Importance of smart, HSTR and Composite materials in ucmp, Applications. Ultrasonic machining – Elements of the process, mechanics of metal removal process parameters, economic considerations, applications and limitations, recent development, Hybrid technologies used in UCMP

Unit 2   Mechanical Processes   10

Abrasive jet machining, Water jet machining and abrasive water jet machining Basic principles, equipments, process variables, mechanics of metal removal, MRR, application and limitations. (AJM and WJM). Working Principles – equipment used – Process parameters –MRR-Variation in techniques used – Applications

Unit 3   Electro – Chemical Processes   10

Fundamentals of electro chemical machining, electrochemical grinding, electro chemical honing and deburring process, metal removal rate in ECM, Tool design, Surface finish and accuracy economic aspects of ECM – Fundamentals of chemical machining, advantages and applications.

Unit 4   Thermal Metal Removal Processes – I   10

General Principle and applications of Electric Discharge Machining, Electric Discharge Grinding and electric discharge wire cutting processes – Mechanics of metal removal in EDM, Process parameters, selection of tool electrode and dielectric fluids, methods surface finish and machining accuracy, characteristics of spark eroded surface and machine tool selection. Wire EDM, principle, applications.

Unit 5   Thermal Metal Removal Processes –II   08

Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non-thermal processes –General Principle and application of laser beam machining – thermal features, cutting speed and accuracy of cut. Application of plasma for machining, metal removal mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries. Chemical machining principle-maskants –etchants- applications. Magnetic abrasive finishing, Abrasive flow finishing.

Prescribed Text Books:

1. Vijay.K. Jain "Advanced Machining Processes" Allied Publishers Pvt. Ltd., New Delhi(2002) ISBN 81-7764-294-4.

Reference Books:

1. Benedict. G.F. "Nontraditional Manufacturing Processes" Marcel Dekker Inc., New York (1987). ISBN, 0824773527.
2. Pandey P.C. and Shan H.S. "Modern Machining Processes" Tata McGraw- Hill, New Delhi (1980). ISBN: 0070965188, 9780070965188
3. Mc Geough, "Advanced Methods of Machining" Chapman and Hall, London (1998) 42 Industrial Robotics 3.0, ISBN 978-0-412-31970-9

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understand the knowledge on need for unconventional machining process and can perform experiments on USM process and are able to apply these concepts in academic research.	L2,L3
2. Learn the working of AJM, WAJM and WJM, can perform experiments on those processes and are able to apply these concepts in academic research.	L2,L3
3. Understand the fundamental concepts of CM, ECM process and can perform experiments on those processes and are able to apply these concepts in academic research.	L2,L3
4. Understand the fundamental concepts of EDM and WEDM process and can perform experiments on those processes and are able to apply these concepts in academic research.	L2,L3
5. Understand the fundamental concepts of LBM, PAM and other surface finish process and can perform experiments on those processes and are able to apply these concepts in academic research.	L2,L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A37CT .1	3	2	-	3	-	-	-	-	-	-	-	2	-	-	-
19A37CT.2	3	3	3	3	1	-	-	-	-	-	-	2	-	-	-
19A37CT .3	3	2	-	3	-	-	-	-	-	-	-	2	-	-	-
19A37CT .4	3	3	3	3	1	-	-	-	-	-	-	2	-	-	-
19A37CT .5	3	3	-	3	-	-	3	-	-	-	-	2	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course	:	Mechatronics
Category	:	PE
Course Code	:	19A37DT
Year	:	IV Year
Semester	:	I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives: This course will

- Familiarize the technologies behind modern mechatronic systems.
- Explain fundamentals for the development of fully automated system.
- Develop a robotic or automated systems focusing on the hardware and software integration.
- Demonstrate the development of mechatronic system and MEMS.

Unit 1   Introduction   09

Definition of Mechatronics, Need for Mechatronics in Industry, Objectives of mechatronics, mechatronics design process, Mechatronics key elements, mechatronics applications–Computer numerical control(CNC) machines, Tool monitoring systems, Flexible manufacturing system(FMS), Industrial Robots, Automatic packaging systems, Automatic inspection systems.

Unit 2 :   Sensors   09

Static characteristics of sensors, Displacement, Position and Proximity sensors, Force and torque sensors, Pressure sensors, Flow sensors, Temperature sensors, Acceleration sensors, Level sensors, Light sensors, Smart material sensors, Micro and Nano sensors, Selection criteria for sensors.

Unit 3   Actuators   09

Mechanical, Electrical, Hydraulic and Pneumatic Actuation systems, Characteristics and their limitations, Design of Hydraulic and Pneumatic circuits, Piezo electric actuators, Shape memory alloys, Selection criteria for actuators.

Unit 4   Microprocessors, Micro controllers and Programmable Logic Controllers   09

Architecture of of Microprocessor, Micro controller and Programmable Logic Controller, PLC Programming using ladder diagrams, logics, latching, sequencing, timers relays and counters, data handling, Analog input/output, selection of controllers.

Unit 5   Micro Electro Mechanical Systems(MEMS)   09

History, Effect of scaling, Fabrication Techniques: Oxidation, Physical Vapor disposition, Chemical Vapor Deposition, Lithography, Etching, Wafer bonding, LIGA, DRIE, and Applications: Labon chip.

Prescribed Text Books:

1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering, W. Bolton, 3/e Pearson Education Press, 2005. ISBN-10 : 0273742868; ISBN-13 : 978-0273742869
2. Devadas Shetty and Richard A Kolk, Mechatronic System Design, 2/e, Cengage learning, 2010. ISBN-10: 1-4390-6199-8
3. Clarence W. de Silva, Mechatronics an Integrated Approach, CRC Press, 2005. ISBN 9780849312748

Reference Books:

Department of Mechanical Engineering

1. James J Allen, Micro Electro Mechanical Systems Design, CRC Press Taylor & Francis group, 2005. ISBN 0-8247-5824-2
2. Ganesh S Hedge, Mechatronics, Jones & Bartlett Learning, 2010. ISBN, 1934015296, 9781934015292

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Explain the role of mechatronics in industry and applications of mechatronics in automation industry.	L3
2. Know about the classification of sensors.	L4
3. Know about classification of actuators and also choose criteria for different actuators.	L4
4. Understand the architecture of microprocessors, microcontrollers and PLC	L1
5. Illustrate the application of MEMS in industry.	L1

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A37DT.1	3	3	-	-	-	-	-	-	3	-	3	-	-	-	-
19A37DT.2	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
19A37DT.3	-	-	-	-	2	-	-	-	2	-	-	-	-	-	-
19A37DT.4	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
19A37DT.5	-	2	-	-	2	-	-	-	-	-	-	-	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course	:	Non-conventional sources of energy
Category	:	PE
Course Code	:	19A37ET
Year	:	IV Year
Semester	:	I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:

- To grasp the role and potential of new and renewable source

- To recognize the principle, storage and applications of solar energy

- To understand the sources and potentials of wind energy and also to comprehend the Principles of Bio-Conversion of bio-mass and bio-gas uses.
- To explain the principle, working procedure and types of geothermal energy, ocean energy and tidal & wave energy.
- To know the knowledge on direct energy conversion.

Unit 1   Principles Of Solar Radiation   09
Role and potential of new and renewable source, the solar energy option, Environmental impact of solar
power, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation , potential in India

Unit 2   Solar Energy Collectors   09
Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors. Solar Energy Storage And Applications: Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion, potential in India.

Unit 3   Wind Energy   08
Sources and potential in India, horizontal and vertical axis wind mills, performance characteristics, Betz criteria. Bio-Mass: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, and economic aspects, potential in India

Unit 4   Geothermal Energy   08
Resources, types of wells, methods of harnessing the energy, potential in India.
Ocean Energy: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics, potential in India.

Unit 5   Direct Energy Conversion   09
Need for DEC, Carnot cycle, limitations, principles of DEC. Thermo-electric generators, Seebeck, Peltier and
Joule Thomson effects, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD Engine, power generation systems, electron gas dynamic conversion, economic aspects. Fuel cells, principles, faraday's law's, thermodynamic aspects, selection of fuels and operating conditions

Prescribed Text Books:

1. Tiwari and MK.Ghosal, Renewable energy resources: Basic principles and applications, Narosa publications 2005, ISBN 10: 1842651250 ISBN 13: 9781842651254
2. G.D. Rai, Non-Conventional Energy Sources, khanna publications, 2011, ISBN 10: 8174090738, ISBN 13: 9788174090737

Reference Books:

1. Twidell & Weir, Renewable Energy Sources, Routledge , 3rd Ed.2015,ISBN 9780367200756
2. Non Conventional Energy Resources, B.H.Khan, McGrawHIII, 2015, ISBN 1259081397, 9781259081392

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Create awareness on role and potential of new and renewable source and basics of solar energy.	L2
2. acquire the knowledge on different types of collectors and storage systems of solar energy and their applications.	L2
3. Able to achieve sufficient knowledge on Wind energy and Bio-mass energy.	L2
4. Familiarize the student with the Geothermal and Ocean energy concepts and their potentiality	L2
5. Gain the knowledge on direct energy conversion	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A37ET.1	3	2	-	-	-	3	3	-	-	-	-	3	-	-	-
19A37ET.2	3	3	-	1	3	3	-	-	-	-	-	3	-	-	-
19A37ET.3	3	2	3	-	-	3	3	-	-	-	-	3	-	-	-
19A37ET.4	3	3	-	-	3	3	-	-	-	-	-	3	-	-	-
19A37ET.5	3	3	-	-	3	3	-	-	-	-	-	3	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course : Mechanical Vibrations
Category : PE
Course Code : 19A37FT
Year : IV Year
Semester : I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:
- To understand the un-damped and damped free vibrations to mechanical systems.
- To know the sources of forced vibrations and Also transmissibility& isolation of vibrations.
- To understand the natural frequencies and modes of forced vibrations.
- To analyze the formulation and model analysis of vibrations and critical speeds of shafts.
- To learn the various vibration transducers and its applications

Unit 1   Single Degree Freedom Systems   09
Single Degree Freedom Systems: Un-damped free vibration: Classical method, Energy method, equivalent systems, And torsional systems. Damped free vibration- Viscous damping, under damping, critical damping, over damping. Coulomb damping, equivalent damping coefficient. Simple problems

Unit 2   Forced vibrations of Single Degree Freedom Systems   10
Forced vibrations of Single Degree Freedom Systems : Steady state forced vibration, sources of excitation, impressed harmonic force, resonance impressed force due to unbalance, motion excitation, transmissibility and isolation, performance of different type of isolators, power absorbed by viscous damping.

Unit 3   Two Degree Freedom Systems   08
Two Degree Freedom Systems: Formulation of Equation of motion, Natural frequencies and modes of vibration by classical method, coupled pendulum, forced vibration, dynamic vibration absorber.

Unit 4   Multi Degree Freedom Systems& Whirling of shafts   10
Multi Degree Freedom Systems: Lagrangian method for formulation of equation of motion Influence co- efficient method, Lumped mass and distributed mass systems, Stodola method, Holzer's method, model analysis of free and forced vibrations.
Whirling of shafts: Critical speed of shafts, Rayleigh's upper bound approximation, Dunkerley's lower bound approximation, critical speed of shafts with damping.

Unit 5   Vibration measurement and Applications   10
Vibration measurement and Applications:Transducers: variable resistance transducers, Piezoelectric transducers, electro dynamic transducers and linear variable differential transformer transducer; Vibration pickups: vibrometer, accelerometer, velometer and phase distortion; Frequency-measuring instruments; Vibration exciters- Mechanical exciters and electro dynamic shaker

Prescribed Text Books:
1. Singrasu S. Rao, Mechanical Vibrations, 6/e, Pearson Education, 2018,ISBN-13:9780132128193
2. G.K.Groover, Mechanical Vibrations, 8/e, 2009, N.Chand & Bros, ISBN-13 :9788185240565
3. Rao.V.Dukkipati & J.Srinivas, PHI 2010, ISBN-13 :9788120345249

4. V.P.Singh, Mechanical Vibrations, Dhanapat Rai & Co, ISBN-13:5551234002564

Reference Books:
1. William Thomson, Theory of Vibrations with Applications, CRS Press , ISBN-13:9780748743803
2. L. Meirovich, Elements of Vibrations Analysis, Tata McGraw Hill, ISBN-13:9789339204716
3. S. Graham Kelly, Mechanical Vibrations, Tata McGraw Hill, 1996, ISBN-13:9781439062128

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Evaluate the natural frequencies and analyse the behaviour of the un-damped single degree freedom systems with damping.	L4, L6
2. Solve vibration problems with forcing functionand combine the transmissibility and isolation.	L3,L5
3. Analyze the natural frequencies and evaluate the modes of two degree freedom systems with and without damping.	L4,L6
4. Analyze the multi degree freedom systems using Stodola method, Holzer˝s method and Matrix iteration method.Develop the natural frequencies with Rayleighs method and Dunkerleys method.	L4,L5
5. Identify various transducers to measure the vibrations and recommend the different vibration pickups and exciters for mechanical vibrations.	L2,L6

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A37FT.1	3	3	-	-	2	-	-	-	-	-	-	-	3	-	-
19A37FT.2	-	-	3	3	-	-	-	-	-	-	-	-	-	2	-
19A37FT.3	-	3	2	-	3	-	-	-	-	-	-	-		3	-
19A37FT.4	3	3	-	-	3	-	-	-	-	-	-	-	2	3	-
19A37FT.5	-	-	-	3	-	3	-	-	-	-	-	-	-	-	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course	:	Total Quality Management
Category	:	PE
Course Code	:	19A37GT
Year	:	IV Year
Semester	:	I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:
- To introduce the students, the basic concepts of Total Quality Management.
- To expose with various quality issues in Inspection.
- To gain Knowledge on quality control and its applications to real time.
- To know the extent of customer satisfaction by the application of various quality concepts.
- To understand the importance of Quality standards in Production.

Unit 1   Introduction   10
Definition of Quality, Dimensions of Quality, Definition of Total quality management, Quality Planning, Quality costs – Analysis, Techniques for Quality costs, Basic concepts of Total Quality Management.

Unit 2   Historical Review   09
Quality council, Quality statements, Strategic Planning, Deming Philosophy, Barriers of TQM Implementation, Benefits of TQM, Characteristics of successful quality leader, Contributions of Gurus of TQM, Case studies.

Unit 3   TQM Principles   08
Customer Satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment teams, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure Case studies

Unit 4   TQM Tools   09
Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA, The seven tools of quality, Process capability, Concept of Six Sigma, New Seven management tools, Case studies.

Unit 5   Quality Systems   08
Need for ISO 9000 and Other Quality Systems, ISO 9000: 2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, QS 9000, ISO 14000 – Concept, Requirements and Benefits, Case Studies.

Prescribed Text Books:
1. Dale H Besterfield, Total Quality Management, Fourth Edition, Pearson Education, 2018, ISBN: 9789332534452
2. Subburaj Ramaswamy, Total Quality Management, Tata Mcgraw Hill Education., 2012, ISBN: 1259001415, 9781259001413
3. Joel E.Ross , Total Quality Management, Third Eition, CRC Press, 2017, ISBN: 9781351407786

Department of Mechanical Engineering

Reference Books:

1. Narayana V and Sreenivasan N.S, Quality Management – Concepts and Tasks, NewAge International, 1996, ISBN-10: 8122416802.
2. Robert L.Flood, Beyond TQM, First Edition, John Wiley & Sons Ltd, 1993, ISBN: 9780471939672.
3. Richard S. Leavenworth & Eugene Lodewick Grant, Statistical Quality Control, Seventh Edition, Tata Mcgraw Hill, 2015, ISBN, 0070241147, 9780070241145.
4. Samuel Ho , TQM – An Integrated Approach, Kogan Page Ltd, USA, 1995, ISBN: 9780749415617.

Course Outcomes:

Student will be able to | Blooms Level of Learning

1. Develop an understanding on quality Management philosophies and frameworks. — L2
2. Adopt TQM methodologies for continuous improvement of quality. — L3
3. Measure the cost of poor quality, process effectiveness and efficiency to identify areas for improvement. — L4
4. Apply benchmarking and business process reengineering to improve management processes. — L3
5. Determine the set of indications to evaluate performance excellence of an organization. — L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A37GT.1	2	-	-	-	-	2	2	-	-	-	2	1	1	1	-
19A37GT 2	2	2	-	2	-	2	-	-	-	1	2	1	1	1	-
19A37GT 3	1	2	-	2	-	-	-	1	1	1	2	1	1	1	-
19A37GT 4	1	-	-	-	-	1	-	-	-	-	2	1	1	1	-
19A37GT 5	1	-	-	-	-	-	-	-	-	-	2	2	1	1	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course	:	CNC and Adaptive Control
Category	:	PE
Course Code	:	19A37HT
Year	:	IV Year
Semester	:	I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:
- To acquaint new technologies in machine tools
- To familiarize part programming mech
- To impart knowledge on CNC machine structure and system drivers
- To explain interpolation algorithms for control loops
- To cover latest developments in CNC system

Unit 1   08
CNC Technology: An overview: Introduction to NC/CNC/DNC machine tools, Classification of NC /CNC machine tools, Advantage, disadvantages of NC /CNC machine tools, Application of NC/CNC.
DNC systems: Classifications, Merits, Demerits and application.

Unit 2   08
Design of CNC: Constructional features of NC/CNC machine tools, C.N.C. tooling and fixturing system, Designation of axis in CNC systems.

Unit 3   10
Part programming: CNC programming and introduction, Manual part programming: Basic (Milling, turning etc..), Special part programming, Advanced part programming, Computer aided part programming (APT).

Unit 4   08
System Drives and devices: Hydraulic and pneumatic motors, and their features, Electrical motors AC/DC and their features.
Interpolators: Hardware Interpolators, Software Interpolators, NC/CNC controllers.

Unit 5   06
Adaptive control systems: Adaptive control with optimizations (ACO), Adaptive control with constraints (ACC).
Latest developments: Machining center, Turing center, Communication networking, recent developments of CNC systems, Virtual NC systems.

Prescribed Text Books:
1. Yoram Koren, Computer Control of Manufacturing Systems, McGraw Hill International, Singapore, 2006. ISBN 0070607435
2. John Stenerson and Kelly Curran, Computer Numerical Control: Operation and Programming, PHI, New Delhi, 2009. ISBN 0130119806
3. TC Chang, RA Wysk and HP Wang, Computer Aided Manufacturing, PHI, New Delhi, 2009. ISBN 0131429191

Reference Books:

1. P. Radhakrishnan, S. Subramanyan& V. Raju, CAD/CAM/CIM, 3/e, New Age International Publishers, 2008. ISBN 9788122427110
2. Mikell P. Groover, Emory W. Zimmers , CAD/CAM, 5/e, Pearson Prentice Hall of India, Delhi, 2008. ISBN 8120304020

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Classify and distinguish NC, CNC and DNC systems	L3
2. Develop manual and APT part programs for 2D complex profiles and test the programs through simulation.	L3
3. Explain CNC machine structures and system drives.	L3
4. Develop interpolation algorithms for control loops.	L3
5. Explain latest developments in CNC system	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A37HT.1	3	3	-	2	2	-	-	-	-	-	-	-	-	3	-
19A37HT.2	3	3	-	2	2	-	-	-	-	-	-	-	-	3	-
19A37HT.3	3	3	-	2	2	-	-	-	-	-	-	-	-	3	-
19A37HT.4	3	3	-	2	2	-	-	-	-	-	-	-	-	3	-
19A37HT.5	3	3	-	2	2	-	-	-	-	-	-	-	-	3	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course	:	CAD/CAM Lab
Category	:	PC
Course Code	:	19A371L
Year	:	IV Year
Semester	:	I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
0	-	2	1

Course Objectives:
- To introduce the basics in modeling software.
- To get the knowledge on Analysis Package.
- To enable the student to develop and to write the part programs for CNC Machines.

Part Modeling:
1. Sketcher
2. Part Modeling

Analysis:
1. Structural analysis
2. Thermal analysis

CAM:
1. Developing CNC code by using CAM package
2. Machining of simple components on CNC Lathe.
3. Machining of simple components on CNC Mill.

Note: Use any convenient software for the content mentioned above

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Develop a part model to visualize the components.	L3
2. Analyze the Structural and Thermal analysis on the various engineering structures or components.	L3
3. Create NC code and automated tool paths for a given engineering component and machine the components.	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A371L.1	3	3	3	3	3	3	-	-	3	3	-	3	-	-	2
19A371L.2	3	3	3	3	3	3	-	-	3	3	-	3	-	-	2
19A371L.3	3	3	3	-	3	-	-	-	3	3	-	3	-	-	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course	:	Instrumentation/Optimization lab with MATLAB software lab
Category	:	PC
Course Code	:	19A373L
Year	:	IV Year
Semester	:	I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
0	-	2	1

Course Objectives:

- To understand the working of pressure gauge, LVDT, Strain gauge, transducers and anemometer
- To calibrate different types of thermocouple
- To familiarize the students with MATLAB interface, using MATLAB as sophisticated calculator with its syntax and semantics.
- Learn how to analyze and solve the engineering problems using programming techniques.

Instrumentation Lab

List of Experiments:

1. Calibration of Pressure Gauges.
2. Calibration of Transducer for Temperature measurement.
3. Study and Calibration of LVDT Transducer for Displacement Measurement.
4. Calibration of Strain Gauge for the measurement of Strain.
5. Calibration of Thermocouple for Temperature Measurement.
6. Calibration of Capacitive Transducer for Angular Measurement.
7. Calibration of Resistance Temperature Detector for Temperature Measurement.
8. Study and Calibration of a Rotometer for flow measurement
9. Study and Calibration of Photo and Magnetic Speed Pickups for the measurement of speed
10. Study of anemometer

Optimization lab with MATLAB software

List of Experiments:

1. Fundamental of numerical computing in MATLAB
2. Graphics in MATLAB / Graphical user interface
3. Programming in MATLAB – I (Logical operators, functions and script files)
4. Programming in MATLAB – II (Conditional statements and loops)
5. Optimization (Linear and Non-linear)

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understand different types of instruments and transducers	L4
2. Understand the working principle of different types of transducers	L4
3. Have aware of the use of numerical methods in modern scientific computing and finite precision computation	L4
4. Express programming techniques for solving engineering problems	L4
5. Use math computations, simulation, modelling, data analysis and processing, graphical visualization and algorithm development	L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A373L.1	3	3	-	3	3	-	-	-	-	-	-	-	-	2	-
19A373L.2	3	3	-	3	3	-	-	-	-	-	-	-	-	2	-
19A373L.3	3	3	-	3	3	-	-	-	-	-	-	-	-	2	-
19A373L.4	3	3	-	3	3	-	-	-	-	-	-	-	-	2	-
19A373L.5	3	3	-	2	3	-	-	-	-	-	-	-	-	2	-

Title of the Course : Power Plant Engineering
Category : PE
Course Code : 19A38AT
Year : IV Year
Semester : II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:
* To understand the student present day energy demand.
* To understand the working and combustion phenomenon in steam power plant.
* To gain knowledge on the concept and the working of diesel power plants and gas turbines.
* To understand the function and operation of the basic components of a hydro-electric power plant & nuclear power station.
* To learn the concept of non-conventional sources and factors affecting the site selection for a power plant and concept of base load plant and peak load plant.

Unit 1 : Introduction 09
Introduction to the Sources of Energy – Resources and Development of Power in India.
Steam Power Plant: Plant Layout, Working of different Circuits, Fuel and handling equipment's, types of coals, coal handling, choice of handling equipment, coal storage, Ash handling systems.

Unit 2 : Steam Power Plant -Combustion Process 09
Properties of coal – overfeed and underfeed fuel beds, travelling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and draught system, cyclone furnace, design and construction, Dust collectors, cooling towers and heat rejection. Corrosion and feed water treatment.

Unit 3 : Internal Combustion Engine Plant-Diesel Power Plant 09
Introduction – IC Engines, types, construction– Plant layout with auxiliaries – fuel supply system, air starting equipment, super charging.
Gas Turbine Plant: Introduction – classification - construction – Layout with auxiliaries – Principles of working of closed and open cycle gas turbines. Combined Cycle Power Plants and comparison.

Unit 4 : Hydro Electric Power Plant 10
Hydro Electric Power Plant: Water power – Hydrological cycle / flow measurement – drainage area characteristics – Hydrographs – storage and Pondage – classification of dams and spill ways.
Hydro Projects And Plant: Classification – Typical layouts – plant auxiliaries – plant operation pumped storage plants.
Nuclear Power Station: Nuclear fuel – breeding and fertile materials – Nuclear reactor – reactor operation- radioactive waste disposal.
Boiling water reactor - Pressurized water reactor - Gas cooled reactor - Fast breeder reactor - Liquid metal cooled reactor-reactor materials - Radiation shielding.

Unit 5 : Power From Non-Conventional Sources 06
Power From Non-Conventional Sources: Utilization of Solar Collectors- Principle of Working, Wind Energy – types – HAWT, VAWT - Tidal Energy.
Power Plant Economics And Environmental Considerations: Capital cost, investment of fixed charges, operating

costs, general arrangement of power distribution, Load curves, and load duration curve. Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor – related exercises. Effluents from power plants and Impact on environment – pollutants and pollution standards – Methods of Pollution control.

Prescribed Text Books:

1. P.K.Nag, Power Plant Engineering. TMH, 4 th Ed.2014. ISBN: 9789339204044, 9339204042
2. P.C.Sharma, Power Plant Engineering. S.K.Kataria& sons ,2014. ISBN 10: 9350143844 / ISBN 13: 9789350143841
3. Arora and S. Domkundwar.A Course in Power Plant Engineering, DhanpatRai& co (p) Ltd, 6 th Ed.2011. ISBN : 8177001957, 9788177001952

Reference Books:

1. Rajput. R.K., A Text Book of Power Plant Engineering. LaxmiPubl, 2015, 5th Ed. ISBN 10: 8131802558 / ISBN 13: 9788131802557
2. Hegde R.K. Power Plant Engineering. Person Publ, 2015. ISBN: 9789332558243
3. C. Elanchezian and L.Sravana Kumar, Power Plant Engineering. I.K. books, 2010. ISBN: 9788189866303
4. A B Gill, Power plant Performance, Butterworth and Co, Ltd.2016. ISBN: 9781483100005

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Recognize the importance of power production suited to the demand. Student can have an idea of various power plants. Student can know the impact of power plants on the environment.	L2
2. Understand the latest high pressure boilers, concept of fluidized bed combustion and importance of handling and storage. Student can able to learn the waste heat recovery methods. In addition, student can know various cooling towers and its application.	L2
3. Grasp concepts of diesel power plant and gas turbine plants. Student can distinguish open cycle and closed cycle gas turbine cycles.	L2
4. Have knowledge on water power. Student can able to understand the methods of storing water and can have an idea over constructions of dams and spill ways. Student can enable to draw the layout of hydel power plant.	L2
5. Understand about the power plant economics.	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A38AT.1	3	2	-	-	-	3	2	-	-	-	-	2	-	-	-
19A38AT.2	3	2	-	-	-	3	2	-	-	-	-	-	-	-	-
19A38AT.3	3	-	-	-	-	3	-	-	-	-	-	-	-	-	-
19A38AT.4	3	-	-	-	-	3	-	-	-	-	-	2	-	-	-
19A38AT.5	3	2	-	-	-	3	-	-	-	-	3	2	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course	:	Composite Materials
Category	:	PE
Course Code	:	19A38BT
Year	:	IV Year
Semester	:	II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:

- To understand the mechanical behavior of composite materials
- To get an overview of the methods of manufacturing composite materials
- Basic knowledge of composites will allow engineers to understand the issues associated with using these materials, as well as gain insight into how their usage differs from metals, and ultimately be able to use composites to their fullest potential.

Unit 1 :   08
Introduction to composites: Fundamentals of composites – Definition – classification– based on Matrix – based on structure – Advantages and applications of composites - Reinforcement – whiskers – glass fiber – carbon fiber - Aramid fiber – ceramic fiber – Properties and applications

Unit 2 :   12
Manufacturing of composite materials: PMC's: bag moulding, compression moulding, pultrusion, filament winding. Processing of MMC – Liquid state processes – solid state processes – Insitu processes. Processing of CMC's: Sintering - Hot pressing-solgel
Hooke's Law for Different Types of Materials,Hooke's Law for a Two Dimensional Unidirectional Lamina - Plane Stress Assumption, Reduction of Hooke's Law in Three Dimensions to Two Dimensions, Relationship of Compliance and Stiffness Matrix to Engineering Elastic Constants of a Lamina.

Unit 3 :   08
Hooke's Law for a Two-Dimensional Angle Lamina, Engineering Constants of an Angle Lamina, Strength Failure theories of an angle lamina- Maximum stress Failure Theory, Tsai–Hill Failure Theory, Tsai–Wu Failure Theory. Macro mechanical analysis of a laminate: Stress–Strain Relations for a Laminate, InPlane and Flexural Modulus of a Laminate

Unit 4 :   10
Micro-Mechanical Analysis of a Lamina: Introduction, Volume and Mass Fractions, Density, and Void Content, Evaluation of the Four Elastic Moduli – Longitudinal young's modulus, Transverse young's modulus, Major Poisson's ratio and In-plane shear modulus by Strength of Materials Approach

Unit 5 :   10
Macro mechanical Analysis of Laminates: Introduction, Laminate code, Stress-strain relations for a laminate, In-plane and flexural modulus of a laminate. Failure criterion of laminates.

Prescribed Text Books:

1. Mechanics of Composite Materials- Autar K. Kaw, 2/e, CRC Press, 2005. ISBN: ISBN 0-8493-1343-0
2. Chawla K.K, Composite materials, 2/e, Springer – Verlag, 1998. ISBN 978-0-387-74365-3

3. Mechanics of Composite Materials, R. M. Jones, Mc Graw Hill Company, New York, 1999. ISBN 1-56032-712-X

Reference Books:

1. Engineering Mechanics of Composite Materials- Isaac and M Daniel, Oxford Univ. Press, 2005. ISBN: 9780195150971
2. A.B. Strong , Fundamentals of Composite Manufacturing, SME, 1989. ISBN 0-87263-358-6
3. Mechanics of Composite Materials and Structures, Madhujit Mukhopadhyay, New York, 2005. ISBN 10: 8173714770 ISBN 13: 9788173714771

Course Outcomes:

Student will be able to   Blooms Level of Learning

1. Know the fundamental concepts of composite materials   L2
2. Explain various manufacturing methods of composites.   L3
3. Analyze the macro mechanics of a lamina.   L4
4. Understand failure theories, and to determine the strength of a lamina.   L2
5. Analyze the macro mechanics of a laminate and failure criterion.   L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A38BT.1	3	3	3	3	-	2	3	-	-	-	-	-	-	2	-
19A38BT.2	3	3	-	-	-	-	-	-	-	-	-	-	1	-	-
19A38BT.3	3	3	3	3	1	-	-	-	-	-	-	-	-	3	2
19A38BT.4	3	3	-	3	-	-	-	-	-	-	-	-	-	2	3
19A38BT.5	3	3	3	3	1	-	-	-	-	-	-	-	-	2	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course   :   Production and Operations Management
Category   :   PE
Course Code   :   19A38CT
Year   :   IV Year
Semester   :   II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:
- To make the students understand the functions of production planning & control, goods and services, issues in product design and to provide knowledge of determining the accurate demand forecasting.
- To provide the knowledge on facilities location, various types layouts, computerized layout planning, and assembly line balancing techniques.
- To make the students understand the concepts of capacity planning and aggregate planning and their planning strategies.
- To make the students understand the concepts of capacity planning and aggregate planning and their planning strategies,
- Able to make knowledge on lean management, concepts of JIT, six sigma, quality control.

Unit 1   Production and Forecasting   10
Production – Products – types – design of goods & services – Functions of Production & Operations Management – Production Vs Productivity – Productivity measurement – Product design & analysis – new product development and its concepts.
Forecasting – Importance of forecasting – Types of forecasting, their uses– Forecasting techniques – qualitative methods and quantitative methods – accuracy of forecasting methods.

Unit 2   Plant Layout   10
Factors affecting facilities location – Single facility location model – Types of facilities layouts: product layout process layout, group technology layout – Assembly line balancing – Computerized layout planning algorithms: ALDEP, CRAFT, and CORELAP.

Unit 3   Capacity Planning and Aggregate Planning   10
Capacity Planning – Plant capacity – strategies of capacity planning – equipment selection.
Aggregate Planning – Strategies of aggregate planning – O.R. models in aggregate planning – chase planning – expediting – controlling aspects.
MRP– Lot sizing techniques in MRP –Introduction to ERP – LOB (Line of Balance).

Unit 4   Scheduling   10
Job Sequencing – Johnson's rule, extension of Johnson's rule, Palmer's rule, and Graphical method.
Scheduling– Techniques – flow shop and job shop Scheduling.

Unit 5   Quality Management   08
Quality Management: Economics of quality assurance-Control charts for variables and for attributes-Acceptance sampling plans - Lean management- philosophy and creation of lean enterprise - JIT concepts - Kanban system - Total Quality Management-ISO 9000 series standards-Six sigma.

Prescribed Text Books:

1. S.N. Chary, *Production and Operations Management*. 5th edition McGraw Hill Edu. Pvt. Ltd, 2012. (ISBN 10: 1259005100ISBN 13: 9781259005107)
2. R. Panneerselvam, *Production and Operation Management.* PHI. 2012. (ISBN, 812034555, 9788120345553.)
3. Operations Management: Theory and Practice: B.Mahadevan Pearson.(ISBN: 9788131730706)

Reference Books:

1. Kanishka Bedi, Production & Operations Management. Oxford Univ. Press. (ISBN: 9780195690873)
2. Martin K. Starr and David W. Miller. Inventory Control Theory and practice. (ISSN: 0925-5273)
3. Buffa and Sarin . Modern Production / Operations Management 8ed ,Wiley.. (ISSN: 1059-1478)

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Describe the basic concepts of production systems, productivity, and design process new products including both goods and services, and determine the future demands by using forecasting techniques.	L1
2. Solve the facility location and layout planning problems using single facility location model, Assembly line balancing, and computerized techniques like CRAFT, CORELAP, and ALDEP.	L1
3. Apply the strategies of capacity planning and aggregate planning while solving O.R. models of production planning. and Lot sizing techniques in MRP, and recognize the importance of ERP and LOB.	L1
4. Produce optimal job sequences, can prepare the schedules of flow shop, job shop scheduling problems.	L1
5. Quality management ,Lean philosophy, creation of Lean enterprise with JIT, Kanban system, TQM elements and Six-Sigma quality control.	L1

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A38CT.1	3	3	3	-	3	-	-	-	3	-	3	-	2	-	-
19A38CT.2	3	3	3	-	3	-	-	-	3	-	3	-	2	-	-
19A38CT.3	3	3	3	-	-	-	-	-	3	-	3	-	2	-	-
19A38CT.4	3	3	3	1	3	-	-	-	3	-	3	-	2	2	-
19A38CT.5	-	3	3	-	3	1	1	-	3	1	3	-	2	2	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course   :   Supply chain Management
Category   :   PE
Course Code   :   19A38DT
Year   :   IV Year
Semester   :   II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:

- To get the knowledge on basic concepts of supply chain management, decision phases, process view and its strategies.
- To learn the concepts of distribution networks and supply chain network
- To acquire the skill of planning, managing safety stock in a supply chain, transportation.
- To know the concept of sourcing and pricing of products.
- To get the awareness on Bullwhip effect and Technology in the Supply Chain

Unit 1   Introduction to SCM: 10
Fundamentals of supply chain, Objective of supply chain and importance, concepts and definitions, Supply chain stages and decision phases, process view of a supply chain. Supply chain flows. Competitive and supply chain strategies, strategic fit, Supply chain Drivers, Examples of supply chains

Unit 2   Designing the Supply Chain Network: 08
Distribution Networks (DN) – Role, Factors, Design of Distribution Networking, e-Business and the Distribution Network.
Supply Chain Network (SCN) – Role, Factors, Framework for Design Decisions. Models for facility location and capacity allocation.

Unit 3   Planning and Managing Inventories in a SCM: 10
The Role of cycle Inventory in a Supply Chain, Managing Multi-Echelon Cycle Inventory, Safety inventory determination. Optimum level of product availability, Managerial levers to improve supply chain profitability.
Transportation: Role of Transportation, Factors affecting transportation decisions. Modes of Transportation and their performance characteristics.

Unit 4 :   Sourcing Decisions in Supply Chain: 08
Role of sourcing, supplier – scoring & assessment, selection and contracts. Design collaboration, procurement, source planning and analysis.
Pricing and Revenue Management in SCM: Role of pricing and Revenue Management in the Supply Chain.

Unit 5   Managing Bullwhip Effect: 08
Co-ordination in a supply chain - Bullwhip effect. The Effect on performance of Lack of co-ordination, Obstacles to coordination. Managerial levers to achieve co-ordination.
Technology in the Supply Chain: The Role of IT supply Chain, The Supply Chain IT Framework, CRM, Internal SCM, SRM. The role of E-Business in a supply chain.

Prescribed Text Books:
1. Sunil Chopra & Peter Meindl; Supply Chain Management-Strategy, Planning & Operation. Pearson Edu. Asia,

2001, ISBN: 81-7808-272-1.

Reference Books:
1. Robert B Handfield, Ernest L Nichols, Jr., Supply Chain Redesign – Transforming Supply Chains into Integrated Value Systems. Pearson Edu. Inc, 2002, ISBN: 81-297-0113-8.
2. Jeremy F Shapiro, Duxbury; Modelling the Supply Chain. Thomson Learning, 2002, ISBN 0-534-37363.
3. David Simchi Levi, Philip Kaminsky& Edith Simchi Levi; Designing & Managing the Supply Chain.McGraw Hill. 2007. ISBN-10 : 9780070666986
4. Dr. Dale S. Rogers, Dr. Ronald S. Tibben-Lembke, Going Backwards Reverse Logistics Trends and Practices. University of Nevada, Reno, Center for Logistics Management. 1999. ISBN, 0967461901, 9780967461908
5. Donald J.Bowersox; sipply chain logistics management. Tata McGraw – Hill, 2008, ISBN: 978-0-07-066703-7.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understanding to align the management of Supply Chain with corporate goals and strategies.	L2
2. Apply problem solving and decision making frame works that propose defensible solutions to organizational opportunities, challenges, change and risk.	L3
3. Understand the fundamental role of logistics as it relates to inventory and transportation.	L4
4. Design co-ordinate and collaborative processes and activities emerging technologies.	L6
5. Apply knowledge to evaluate and mange an effective supply chain information systems.	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A38DT.1	3	3	-	-	3	-	-	3	-	3	3	3	2	-	-
19A38DT.2	3	-	3	3	3	-	-	3	-	3	3	3	-	-	3
19A38DT.3	3	3	-	3	3	-	-	3	-	3	-	3	-	2	-
19A38DT.4	3	3	3	3	3	-	-	3	-	3	3	3	-	2	-
19A38DT.5	-	-	3	-	3	1	-	-	-	-	3	3	-	-	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course: Disaster Management
Category   :   OE
Course Code   :   19A18DT
Year   :   IV B. Tech
Semester   :   II Semester (Common to CE, ME, CSE)

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:

- The course is intended to provide a general concept in the dimensions ofdisasters caused by nature beyond the human control as well as the disastersand environmental hazards induced by human activities with emphasis ondisaster preparedness, response and recovery.

Unit 1 :   09
Introduction - Concepts and definitions: disaster, hazard, vulnerability, risk, capacity, prevention, mitigation).

Unit 2 :   09
Disasters - Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills etc); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

Unit 3 :   09
Disaster Impacts - Disaster impacts (environmental, physical, social, ecological, economical, political, etc.); health, psycho-social issues;demographic aspects (gender, age, special needs); hazard locations; global andNational disaster trends; climate-change and urban disasters.

Unit 4 :   09
Disaster Risk Reduction (Drr) - Disaster management cycle–its phases; prevention, mitigation, preparedness, relief and recovery; structural andnon-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post-disaster environmental response (water, sanitation, food safety, waste management, disease control); Roles and responsibilities ofgovernment, community, local institutions, NGOs and other stakeholders;Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

Unit 5 :   09
Disasters, Environment and Development - Factors affecting vulnerability suchas impact of developmental projects and environmental modifications (includingof dams, land-use changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.

Prescribed Text Books:
1. Disaster Management Guidelines, GOI-UND Disaster Risk Program (2009-2012)
2. Damon, P. Copola, (2006) Introduction to International Disaster Management, Butterworth Heineman.
3. Gupta A.K., Niar S.S and Chatterjee S. (2013) Disaster management and Risk Reduction, Role of Environmental Knowledge, Narosa Publishing House, Delhi.
4. Murthy D.B.N. (2012) Disaster Management, Deep and Deep Publication PVT. Ltd. New Delhi.
5. Modh S. (2010) Managing Natural Disasters, Mac Millan publishers India LTD.

Department of Mechanical Engineering

Reference Books:

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority).
2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministryof Home Affairs).
3. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
4. Singh B.K., 2008, Handbook of Disaster Management: techniques &Guidelines, Rajat Publication.
5. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. The students increase the knowledge and understanding of the disaster phenomenon and, its factors.	L1
2. The students must learn various classification of disasters hazard and vulnerability profile of India.	L4
3. The students will learn impacts, global and national disaster trends	L2
4. The students will learn disaster management cycle and its phases and DRR programmes in India and activities of national disaster management academy.	L3
5. The students should be able to analyze factors affecting vulnerability of developmental projects and environmental modifications for sustainable development.	L6

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A18DT.1	-	-	-	-	2	1	-	2	2	2	-	-	-	-	-
19A18DT.2	1	-	-	-	-	-	-	2	3	3	-	2	-	-	-
19A18DT.3	1	-	-	-	-	3	-	3	2	2	-	-	-	-	-
19A18DT.4	-	-	-	-	-	-	-	3	3	3	-	2	-	-	-
19A18DT.5	1	-	-	-	-	-	2	3	-	-	-	3	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course	:	Building Planning and Construction
Category	:	OE
Course Code	:	19A18ET
Year	:	IV B. Tech
Semester	:	I Semester (Common to CE, ME, CSE)

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives:
- Teach to supervision of different types of masonry
- Illustrate the methodology in selection of materials, design and supervision of suitable type of floor and roof
- To ensure the student to be aware of building byelaws.
- To make the student to understand about principles of planning, standards and requirements of Residential building and Public building

Unit 1 :   Building Byelaws and Regulations   08
Introduction –Terminology –Objectives of building byelaws –Floor area ratio (FAR) –Floor space Index (FSI) – Principles underlying building byelaws –classification of buildings –Open space requirements –built up area limitations –Height of Buildings –Wall thickness –lighting and ventilation requirement.

Unit 2 :   *Residential buildings*   10
Minimum standards for various parts of buildings –requirements of different rooms and their grouping –characteristics of various types of residential buildings. Principles of planning- architectural principle, Aspects of planning within and with respect to surroundings, Modular planning concept.

Unit 3 :   Public buildings   10
Planning of Educational institutions, hospitals, dispensaries, Office buildings, banks, industrial buildings, hotels and motels, buildings for recreation. Elements of Perspective Drawing: Definition, concept and single and two point perspective

Unit 4 :   *Masonry & foundations*   09
  Masonry: Types of masonry, English and Flemish bonds, Rubble and Ashlar masonry, cavity and partition walls.
  Foundations: Shallow foundations – Spread, combined, strap and mat foundations.

Unit 5 :   08
Building components: Lintels, Arches, and stair cases – Types. Different types of floors-Concrete, Mosaic, Terrazo floors, Pitched, flat and curved Roofs. Lean-to-Roof, Coupled Roofs, Trussed roofs- King and Queen Post Trusses. RCC Roofs.
Finishings: Damp proofing- materials used. Plastering, pointing, white washing and distempering – Painting – Constituents of a paint – Types of paints – Painting of new/old Wood – Varnish – Form work and scaffolding.

PrescribedText Books:
1. Building Planning & Drawing by Dr N. Kumaraswamy and A.Kameswara Rao, Charitor Publications.
2. Planning and Designing and Scheduling- Gurucharan Singh and Jagadish Singh – Standard Publishers.
3. Planning and Designing of Buildings – Y.S.Sane.
4. Building Construction by P.C. Varghese, Prentice-Hall of India private Ltd, New Delhi.
5. Building Construction by B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain - Laxmi Publications (P) ltd., New Delhi.

Reference Text books:

1. Sikka, V.B. (2013), A Course in Civil Engineering Drawing, S. K. Kataria& Sons
2. R.Chudly "Construction Technology "– Volumes I and II" 2nd Edition, Longman, UK, 1987.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understand Building Byelaws & regulations.	L2
2. Understand principles of planning, standards and requirements for residential building.	L2
3. Understand principles of planning, standards and requirements for public building.	L2
4. Summarize different types of masonry and foundations	L3
5. Understand different types of building components and finishing works	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A18ET.1	-	-	-	-	-	3	1	-	2	-	-	-		2	3
19A18ET.2	-	-	-	-	-	3	1	-	2	-	-	-		2	3
19A18ET.3	-	-	-	-	-	3	1	-	2	-	-	-		2	3
19A18ET.4	-	-	-	-	-	3	1	-	2	-	-	-		2	3
19A18ET.5	-	-	-	-	-	3	1	-	2	-	-	-		2	3

Title of the Course   Battery Energy Storage Systems
Category   OE
Course Code   19A28DT
Year   IV B. Tech
Semester   II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	1	-	3

Course Objectives:
1. To enable the student to understand the need for Energy Storage.
2. To learn sufficient knowledge about various Energy Storage Technologies.
3. To deal with grid connected Battery Energy Storage System.
4. To study the Challenges, Risk and Policy of Battery Energy Storage System.

Unit I   Introduction to Energy Storage for Power Systems   12
Emerging needs for Electrical Energy Storage -Role of Energy Storage Systems-Applications. Overview of energy storage technologies: Thermal, Mechanical, Chemical, Electrochemical, Electrical-Efficiency of Energy Storage Systems.

Unit II   Energy Storage Technologies   10

Storage Types - Components of a Battery Energy Storage System (BESS) - Energy Storage System Components - Grid Connection for Utility-Scale BESS Projects -Battery Chemistry Types -Lead–Acid (PBA) Battery - Nickel–Cadmium (Ni–Cd) Battery-Lithium-Ion (Li-Ion) Battery.

Unit III   Grid Applications of Battery Energy Storage Systems   10
Scoping of BESS Use Cases - General Grid Applications of BESS -Technical Requirements -Round-Trip Efficiency - Response Time - Lifetime and Cycling - Sizing - Operation and Maintenance.

Unit IV   Challenges and Risks   10
 Grid Tariff Applications and Licensing Issues -Battery Safety - Challenges of Reducing Carbon Emissions - Battery Recycling and Reuse Risks -Examples of Battery Reuse and Recycling - Reuse of Electric Vehicle Batteries for Energy Storage - Recycling Process.

UNIT V   Policy Recommendations   10
Frequency Regulation - Renewable Integration -Distribution Grids -Transmission Grids - Peak Shaving and Load Leveling - Microgrids

Text Books:
1. YongpingZhai. *Handbook on Battery Energy Storage System*Asian Development Bank.2018.
2. James M. Eyer, Joseph J.Iannucci and Garth P. Corey .*Energy Storage Benefits and Market Analysis*, Sandia National Laboratories, 2004.
3. Jim Eyer, Garth Corey", *Energy Storage for the Electricity Grid*: Benefits and Market Potential Assessment Guide, Report, Sandia National Laboratories, Feb 2010.

Reference Books:
1. Doughty, D. H., and E. Peter Roth. 2012. A General Discussion of Li Ion Battery Safety. Electrochemical Society Interface 21 (2): 37–44. DOI: 10.1149/2.F03122if.
2. Electric Power Research Institute (EPRI). 2010. Electricity Energy Storage Technology Options: A White Paper Primer on Applications, Costs, and Benefits. Palo Alto, California, US. http://large. stanford.edu/courses/2012/ph240/doshay1/docs/EPRI.pdf

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3. Enel Green Power. 2016. Integrating Renewable Power Plants with Energy Storage. 7 June. http://www.iefe.unibocconi.it/wps/wcm/connect/29b685e1-8c34-4942-8da3-6ab5e701792b/ Slides+Lanuzza+7+giugno+2016.pdf?MOD=AJPERES&CVID=lle7w78.
4. Initial Operating Experience of the La Ola 1.2-MW Photovoltaic System. Sandia National Laboratories Report SAND2011-8848. Kane, Mark. 2015. Bosch Cooperates With BMW And Vattenfall In Second Life Battery Project. Inside EVs 9 February. https://insideevs.com/bosch-cooperates-with-bmw-and-vattenfall-in-second-lifebattery-project/

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

1. Understanding the need of the Energy Storage Systems.
2. Study and analyse the function of each storage Technology, its Types.
3. Explore the Battery Energy Storage applications in Renewable energy systems and in Smart grid.
4. Study the Challenges, Risk and Policy recommendation of Battery Energy Storage Systems.

COs-POs-PSOs Mapping

Course Outcomes	Program Outcomes												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	2	1
19A28DT .1	2	-	-	1	-	-	1	-	1	-	-	-	1	-
19A28DT .2	2	2	1	1	-	-	1	-	-	-	-	-	1	-
19A28DT .3	2	1	1	1	-	-	1	-	2	-	-	-	1	1
19A28DT .4	2	1	1	1	-	-	2	-	1	-	-	-	2	1

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Title of the Course	:	System modeling and Simulation
Category	:	OEC
Course Code	:	19A28ET
Year	:	IV Year
Semester	:	II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:
- To understand the basic system concepts and definitions of system
- Techniques to model and to simulate various systems
- To analyze a system and to make use of the information to improve the performance

Unit 1   Introduction to simulation models   10

Basic Simulation Modeling, Systems, Advantages and disadvantages of simulation, Models and Simulation, Discrete Event Simulation, Simulation of Single Server Queuing System, Simulation of Inventory System, Alternative approach to Modeling and Simulation

Unit 2   Simulation software   10

Description of links and joints, Kinematic modeling of manipulator, Translation and Rotation Representation, Coordinate transformation, Denavit - Hartenberg (DH) notation, Examples of DH notation, Jacobian, Singularity, and Statics.

Unit 3   Trajectory Planning and Manipulator   08

Control Terminology, Steps in trajectory planning, Joint space techniques, path description, Use of polynomials as interpolating function, various trajectories, Introduction to Cartesian space techniques.

Unit 4   End effectors, sensors and vision system   08

Tools as end effectors, Robot Grippers - Types of Grippers, Design aspect for gripper, Force analysis for various basic gripper system. Sensors for Robots - Characteristics of sensing devices, Classification, applications and selection of sensors. Robotic vision system, image acquisition, spatial and amplitude digitization, image processing and analysis.

Unit 5   Robot programming and applications   10

Robot applications in material handling, machine loading/unloading, assembly, inspection and processing.
Robot Programming – Methods, Lead through methods, Robot Programming-Language overview, commands for elementary operations

Prescribed Text Books:
1. Saha, S.K., "Introduction to Robotics, 2nd Edition, McGraw-Hill Higher Education, New Delhi, 2014. , ISBN - 0070140014
2. Ghosal, A., "Robotics", Oxford, New Delhi, 2006. ISBN - 9780195673913
3. Niku Saeed B., "Introduction to Robotics: Analysis, Systems, Applications", PHI, New Delhi. 2001. ISBN - 0130613096

Reference Books:
1. Tsuneo Yoshikawa, Foundations of Robotics, MIT Press. Roy. 2010. ISBN - 0262514583
2. Mittal R.K. and Nagrath I.J., "Robotics and Control", Tata McGraw Hill. 2017, ISBN - 9780070482937

3. Mukherjee S., "Robotics and Automation", Khanna Publishing House, Delhi. 2017. 2017, ISBN - 9386173751

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understand the concept of Robots, Structure and its specifications.	L2
2. Solve robot forward and inverse kinematic problems.	L5
3. Carry out trajectory planning and joint modeling for the simple robotic system.	L4
4. Identify appropriate end effectors and sensors for particular application	L4
5. Execute various steps robot programming and Knowledge will be gained on application of Robotics used in various sectors.	L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A36FT.1	3	3	3	-	-	3	3	3	-	-	-	-	-	-	-
19A36FT.2	2	2	2	-	-	2	-	2	-	-	-	-	-	-	-
19A36FT.3	1	1	1	-	-	-	-	1	-	-	-	-	-	-	-
19A36FT.4	1	1	1	-	-	-	-	1	-	-	-	-	-	-	-
19A36FT.5	2	-	2	-	-	2	-	2	-	2	-	-	-	-	-

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Title of the Course   :   Introduction to Digital Design
Category   :   OE
Course Code   :   19A48DT
Year   :   IV B.Tech.
Semester   :   II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives: The course aims to provide the student with the ability

- To get the knowledge on Number Systems and codes.
- To gain the knowledge on Boolean algebra.
- To acquire the knowledge of various circuits in Digital design.

Unit 1 :   Number systems, Codes & Boolean Algebra   14

Philosophy of number systems – r, (r-1)"s complement, representation of negative numbers, binary arithmetic, binary codes, error detecting & error correcting codes, hamming codes. Boolean algebra: Fundamental postulates of Boolean algebra, Basic theorems and properties, digital logic gates, properties of XOR gate, universal gates.

Unit 2 :   Switching Functions and Their Minimization   14

Switching Functions-Canonical and Standard forms, algebraic simplification using Boolean theorems, two level & Multilevel Realization of Boolean Functions using Universal Gates. Minimization: K-Map methods, Prime implicants, don"t care combinations, Minimal SOP and POS forms, Tabular Method, Prime-Implicants chart, simplification rules

Unit 3 :   Combinational Logic Design & Programmable Logic Devices   10

Design using conventional logic gates-Binary Adders, Subtractors, Ripple Adder, carry Look Ahead adder, Magnitude comparator, Encoder, Decoder, Multiplexer, De-Multiplexer, Code converters. PLD's: ROM, PROM, PLA, PAL, and Realization of Switching functions using PLD"s. Comparison between PLA, PAL, ROM.

Unit 4 :   Sequential Circuits   9

Classification of sequential circuits (Synchronous, Asynchronous, Pulse mode, Level mode with examples),Basic flip-flops, Triggering and excitation tables, flip flop conversions, Steps in synchronous sequential circuit design, Design of modulo-N Synchronous counters – up/down counter, ring counter, Johnson counter

Unit 5 :   FSM Minimization and ASM Chart   12

Finite state machine- capabilities and limitations, Mealy and Moore models and their conversions Sequence detector, Serial binary adder. Minimization of completely specified sequential machines-Partition techniques. Salient features of the ASM chart, Simple examples

Prescribed Text Books:
1. Morris Mano, Digital Design. Prentice Hall India, 3 rdEd.
2. ZVI Kohavi and Niraj K. Jha Switching & Finite Automata theory. Tata McGraw Hill, 3 rdEd.

Reference Text books:
1. Charles H. Roth, Fundamentals of Logic Design. Thomson Publications, 2004, 5 th Ed.
2. Fletcher, an Engineering Approach to Digital Design. Prentice Hall India.
3. Anand Kumar, Switching Theory and Logic Design. Prentice Hall India, 2008.

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Course Outcomes:

Upon completion of the course, student can	Blooms Level of Learning
1. Understand different number systems conversions & Binary codes	L2
2. Simplify Boolean functions& realize them using digital logic gates.	L5
3. Design various combinational & sequential circuits.	L6
4. Understand the Minimization techniques of Finite State Machine & the elements of ASM chart.	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A48DT.1	2	3	2	-	2	-	-	1	-	-	2	-	3	-	-
19A48DT.2	2	2	2	-	-	1	-	1	-	-	2	-	2	2	-
19A48DT.3	2	2	2	-	-	1	-	1	-	-	2	-	-	3	-
19A48DT.4	2	2	2	-	-	1	-	1	-	-	2	-	-	3	-

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Title of the Course   :   Industrial Electronics
Category   :   OE
Course Code   :   19A48ET
Year   :   IV B.Tech.
Semester   :   II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives: This course will able to
- Power quality terminology, power quality issues, classification
- Different sources of power quality disturbances
- Harmonic distortion; Principles for controlling harmonics
- Power quality measuring equipment; Power quality monitoring standards
- Impact of distributed generation on power quality

Unit 1 :   Introduction To Power Quality   08
Power Quality- definition, terminology, issues, evaluation procedure, responsibilities of the suppliers and users of electric power, power quality standards, CBEMA and ITI curves.

Unit 2 :   Power Quality Disturbances   10
General classes of power quality problems- Impulsive and oscillatory transients. Long duration voltage variations - over voltage, under voltage, sustained interruption. Short duration voltage variations-interruption, sag, swell and outage. Sources of sags and interruptions, estimating voltage sag performance overview of mitigation methods.

Unit 3 :   Fundamentals Of Harmonics   10
Harmonic distortion, voltage versus current distortion, harmonics versus transients, power system quantities under non-sinusoidal conditions, harmonic indices. Harmonic sources from commercial and industrial loads. Effects of harmonic distortion. Applied harmonics - harmonic distortion evaluation, principles of controlling harmonics, and devices for controlling harmonic distortion. Harmonic filter design and standards on harmonics.

Unit 4 :   Power Quality Monitoring   09
Power quality benchmarking, monitoring considerations, choosing monitoring locations, permanent power quality monitoring equipment, historical perspective of power quality measuring instruments. Power quality measurement equipment-types of instruments, assessment of power quality measurement data, power quality monitoring standards.

Unit 5 :   Distributed Generation And Grid Interconnection   08
Distributed generation -connection requirements and impacts on the network. Interaction and optimal location of DG-Eigen analysis and voltage interaction. Power quality in DG-Mitigation of voltage dip during motor start, harmonic effects with DG, voltage flicker and fluctuation. Islanding issues, distribution line compensation-heavy Load and Light load condition, real generation, protection issues for distributed generation, technologies for distributed generation, power quality impact from different DG types.

Prescribed Text Books:
1. Roger C. Dugan, Mark F. McGranaghan, Surya Santoso, H. Wayne Beaty, Electrical Power Systems Quality, 3rd edition, TMH Education Pvt. Ltd., 2012.
2. ArindamGhosh, Gerard Ledwich, Power quality enhancement using custom power devices, Kluwer academic publishers, 2002

Reference Text books:
1. G.T. Heydt, Electric Power Quality, Stars in a circle Publications, 1991. USA.

2. SurajitChattopadhyaya, MadhuchhandaMitra, SamarjitSenugupta, Electrical Power Quality, Springer Dordrecht Heidelberg London New York.
3. Math H. J. Bollen, Understanding Power quality problems, IEEE Press, 2007.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Demonstrate knowledge on sources of power quality disturbances and issues, power quality monitoring and measuring instruments, power quality standards, effect of distributed generation on power quality.	L1
2. Analyze various power quality issues.	L3
3. Design a suitable harmonic filter for commercial and industrial loads.	L4
4. Investigate various power quality issues and provide feasible solutions for improvement of power quality.	L5
5. Select and use appropriate equipment for monitoring and measurement of power quality.	L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A48ET.1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
19A48ET.2	2	3	-	-	-	-	-	-	-	-	-	-	3	-	-
19A48ET.3	1	2	3	-	-	-	-	-	-	-	-	-	3	-	-
19A48ET.4	3	3	-	-	3	-	-	-	-	-	-	-	-	3	-
19A48ET.5	2	2	-	-	3	-	-	-	-	-	-	-	-	3	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course : Internet of Things
Category : OE
Course Code : 19A58ET
Year : IV B. Tech
Semester : II Semester (Offered to CE, EEE, ME & ECE)

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives: This course will able to
- To understand the terminology, technology and its applications of IoT.
- To know the concept of M2M (machine to machine) with necessary protocols.
- To memorize the software platforms which are used for developing the applications.
- To learn the concepts of python programming language which is used to develop the IoT projects.
- To know the hardware platforms which is necessary to develop the IoT applications.

Unit 1 :   Introduction to Internet of Things   08
Introduction to Internet of Things, History of IoT, Physical Design of IoT, Logical Design of IoT,
IoT Enabling Technologies, IoT Levels & Deployment Templates, Applications of IoT.

Unit 2 :   IoT and M2M& IoT Platforms Design Methodology   07
IoT and M2M: Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT.
IoT Platforms Design Methodology: Introduction, IoT Design Methodology.

Unit 3 :   The Wireless Embedded Internet   08
Introduction to 6LoWPAN,The 6LoWPAN Architecture ,The Basic 6LoWPAN Format, Addressing
MQ telemetry transport for sensor networks (MQTT-S), ZigBee compact application protocol, Contiki and uIPv6,
Wireless RFID Infrastructure.

Unit 4 :   IoT Systems-Logical Design Using Python   08
Introduction, Installing Python, Python Data Types and Data Structures, Control Flow, Functions,
Modules, Packages and File Handling.

Unit 5 :   IoT Physical Devices and Endpoints   08
What is an IoT Device, Exemplary Device: Raspberry Pi, About the Board, Linux on Raspberry
Pi, Raspberry Pi Interfaces, Programming Raspberry Pi with Python, Other IoT Devices.

PrescribedText Books:
1. Internet of Things, A Hands-On Approach, ArshdeepBahga, Vijay Madisetti, University Press,2015.
2. 6LoWPAN: The WirelessEmbedded Internet, Zach Shelby and CarstenBormann,Wiley publications, first edition,2009.(Unit III).

Reference Text books:
1. The Internet of Things Connecting Objects to the Web, HakimaChaouchi,Wiley publications,2010.
2. Designing the Internet of Things,Adrian McEwen, Hakim Cassimally, Wiley 2014.
3. Enterprise IoT, A Definitive Handbook by Naveen Balani.

Course Outcomes:
Student will be able to   Blooms Level of Learning
1. Understand the vision of IoT from a global context.   L1
2. Identify the difference between IoT and M2M communication.   L3
3. Determine the usage of 6LoWPAN and select the appropriate network   L4
   protocols for IoT project.

4. Create the IoT experiments with the help of Python programs.   L5
5. Design the IoT applications using Raspberry Pi kit.   L6

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19A58ET .1	-	-	-	3	3	3	1	1	-	-	-	1
19A58ET .2	-	-			3	-	-	-	-	1	-	-
19A58ET 3	-	-	3	3	3	-	-	-	-	-	-	-
19A58ET 4	-	-	3	3	-	-	-	-	-	-	-	-
19A58ET 5	1	1	3	3	3	3	-	-	-	-	-	-

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Title of the Course	Web Programming
Category	OE
Course Code	19A58FT
Year	IV B. Tech
Semester	II Semester (Common to CE, EEE, ME, ECE)

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives: This course will make the students
- Interpret and use HTML concepts in developing the web pages
- Use the CSS to design web pages.
- Interpret the JavaScript programming language
- Interpret the JavaScript framework using JQuery

Unit 1 :   09
Structuring Documents for the Web-A Web of Structured Documents, Introducing HTML5, Tags and Elements, Attribute Groups Core Attributes, Internationalization, Core Elements ,Basic Text Formatting, Understanding Block and Inline Elements, Grouping Content, Working with Lists, Text Processing tags, Links and Navigation :Basic Links, Understanding Directories and Directory Structures, Understanding URLs, Creating In-Page Links with the <a> Element.

Unit 2 :   Images, Audio, and Video, Tables, Forms   09
Images, Audio, and Video -Adding Images Using the <img> Element, Using Images as Links Adding Flash, Video, and Audio to Your Web Pages Tables: Introducing Tables, Basic Table Elements and Attributes, adding a Caption to a Table, Grouping Sections of a Table, Nested Tables, Accessible Tables. Forms: Introducing Forms, creating a Form with the <form> Element, Form Controls, Creating Labels for Controls and the <label> Element, Structuring Your Forms with <fieldset> and <legend> Elements, Focus, Disabled and Read-Only Controls, Sending Form Data to the Server, Creating More Usable Form Fields.

Unit 3 :   Cascading Style Sheets, Introduction to XML   09
Cascading Style Sheets: Introducing CSS, Where You Can Add CSS Rules, CSS Properties Controlling Text, Text Formatting, Text Pseudo-Classes, Styling Text, Selectors Lengths, Introducing the Box Model, An Example Illustrating the Box Model, Links, Backgrounds, Lists, Tables, And Miscellaneous Properties.
Introduction to XML: Difference between HTML and XML, Basic structure and Syntax of XML Document, DTD, sample examples.

Unit 4 :   Learning JavaScript   09
Learning JavaScript-Introduction to JavaScript, How to Add a Script to Your Pages, comments in JavaScript, Create an External JavaScript ,The Document Object Model, JavaScript Programming console, General Programming Concepts, Variables, Operators, String Operators (Using + with Strings), Functions, Conditional Statements, Looping, Events, Built-in Objects.

Unit 5 :   Working with jQuery   09
Working with jQuery: introduction to jQuery, adding jQuery to Your Page, jQuery Basics, jQuery and the DOM, Managing Events with jQuery, Ajax with jQuery, jQuery UI.

Prescribed Text Books:
1. Beginning HTML and CSS Rob Larsen, Wrox Programmer to Programmer.

Reference Books:
1. JavaScript and JQuery: Interactive Front-End Web Development, Jon Duckett, Wiley Publications
2. Web Design with HTML, CSS, JavaScript and jQuery Set, Jon Duckett, Wiley Publications
3. jQuery in Action, Bear Bibeault, Yehuda Katz, and Aurelio De Rosa, Third Edition, Manning Publications
4. https://www.w3schools.com/

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Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Interpret and Use the fundamental HTML markups when designing web pages.	L2, L3, L5
2. Use and design the web pages with images, audio, videos, tables and form controls.	L3, L5
3. Use cascading style sheets and XML concepts to design web pages	L3, L5
4. Interpret and use JavaScript concepts in designing web pages	L2, L3, L5
5. Interpret and use JQuery concepts in designing web pages.	L2, L3, L5

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19A534T.1	3	-	3	3	3	-	-	-	-	-	-	3
19A534T.2	-	-	3	3	3	-	-	-	-	-	-	3
19A534T.3	-	-	3	3	3	-	-	-	-	-	-	3
19A534T.4	3	-	3	3	3	-	-	-	-	-	-	3
19A534T.5	3	-	3	3	3	-	-	-	-	-	-	3