II Year I Semester

Sl. No.	Category	Course Code	Course Title	Hours per Week			Credits
				L	T	P	C
1	BS	24AMAT31T	Complex Variables and Partial Differential Equations	3	0	0	3
2	ES	24AMEC31T	Basic Thermodynamics	3	0	0	3
3	PC	24AMEC32T	Manufacturing processes	3	0	0	3
4	PC	24AMEC33T	Mechanics of Solids	3	0	0	3
5	PC	24AMEC34T	Material Science and Metallurgy	3	0	0	3
6	PC	24AMEC35L	Mechanics of Solids & Materials Science lab	0	0	3	1.5
7	PC	24AMEC32L	Manufacturing processes Lab	0	0	3	1.5
8	SEC	24AMEC36T	Computer-Aided Drafting and Design (with AutoCAD & CATIA)	1	0	2	2
9	MC	24AENS31T	Environmental Science	2	0	0	0
						Total Credits	**20**

II Year II Semester

Sl. No.	Category	Course code	Course Title	Hours per Week			Credits
				L	T	P	C
1	HSM	24AMEC41T	Industrial Management	3	0	0	3
2	BS	24AMAT41T	Probability & Statistics	3	0	0	3
3	HSM	24AUHV41T	Universal Human Values–II	3	0	0	3
4	PC	24AMEC42T	Fluid Mechanics & Hydraulic Machines	3	0	0	3
5	PC	24AMEC43T	Theory of Machines	3	0	0	3
6	PC	24AMEC44T	Thermal Energy Systems	3	0	0	3
7	PC	24AMEC42L	Fluid Mechanics & Hydraulic Machines Lab	0	0	3	1.5
8	PC	24AMEC43L	Theory of Machines Lab	0	0	3	1.5
9	SEC	24ACSE47L	Python for Data Science	1	0	2	2
						Total Credits	**23**
Mandatory Community Service Project/ Internship of 08 weeks duration during summer Vacation							

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RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course: Complex Variables and Partial Differential Equations
Category: BS
Semester: III Semester
Course Code: 24AMAT31T
Branch/es: Mechanical Engineering

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

1. To understand Complex variable theory and its techniques.
2. To gain knowledge on formulation and solution of partial differential equations.
3. To provide knowledge of mathematical methods to model and solve engineering problems in areas such as fluid dynamics, heat transfer, and electromagnetic fields.

Course Outcomes:

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

1. Apply the method to construct specific analytic functions from given data or conditions.
2. Apply complex integration methods and analyze power series to solve problems in complex analysis.
3. Apply residue theorem and Rouche's theorem to evaluate complex integrals and determine zeros of complex functions.
4. Solve complex function transformations involving translations, rotations, inversions, and standard functions.
5. Solve one-dimensional wave and heat equations to model and interpret physical phenomena.

Unit 1 Complex Variable – Differentiation 10

Introduction to functions of complex variable-Definitions of Limit & continuity- Differentiation, Cauchy-Riemann equations (in Cartesian and polar form without proof), analytic functions, harmonic functions, finding harmonic conjugate-construction of analytic function by Milne Thomson method.

Unit 2 Complex Variable – Integration 10

Line integral-Contour integration, Cauchy's integral theorem (Simple Case), Cauchy Integral formula, generalized Cauchy integral's formula.

Complex power series: Radius of convergence – Expansion in Taylor's series, Maclaurin's series and Laurent series (without proof).

Unit 3 Residues 10

Residues: Singular point – Isolated singular point – Pole of order m – Essential singularity. Residue – Evaluation of residues – Residue theorem.

Evaluation of the integral of the type $\int_0^{2\pi} f(\cos\theta, \sin\theta)\, d\theta$

Determination of Zeros: Rouche's theorem(without proof).

Unit 4 Conformal mapping 08

Definition – Translation, rotation, and inversion –-Transformation by $e^z, lnz, z^2, z^n, sinz\ and\ cosz$. Bilinear transformation -Fixed points– Cross ratio – Determination of bilinear transformation mapping for three given points.

Unit 5 Applications of Partial Differential Equations 08

Method of separation of variables- second order partial differential equations- solutions of 1D-wave- 1D-heat and 2D-Laplace equations in Cartesian coordinates.

Prescribed Textbooks:

4. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.
5. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.

Reference Books:

6. B. V. Ramana, Higher Engineering Mathematics, Mc Graw Hill Education.
7. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
8. R.L. Garg Nishu Gupta, Engineering Mathematics Volumes-I &II, Pearson Education
9. H. K. Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand.
10. B. V. Ramana, Higher Engineering Mathematics, Mc Graw Hill Education.

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Engineering tool usage	The Engineer and the World	Ethics	Individual and Collaborative Team work	Communication	Project management and finance	Life-long learning
24AMAT31T.1	3	2	1	2	-	-	-	-	-	-	1
24AMAT31T.2	3	2	1	2	-	-	-	-	-	-	1
24AMAT31T.3	3	2	1	2	-	-	-	-	-	-	1
24AMAT31T.4	3	3	1	2	-	-	-	-	-	-	1
24AMAT31T.5	3	2	1	2	-	-	-	-	-	-	1

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(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course: **Basic Thermodynamics**
Category: ES
Semester: III Semester
Course Code: 24AMEC31T
Branch/es: Mechanical Engineering

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

1. To impart the awareness on laws of thermodynamics.
2. To enable the students to understand second law of thermodynamics and its applications to various systems.
3. To familiarize steam properties to understand working of steam power plants.
4. To acquire knowledge on equations of state and properties of gas mixtures.
5. To understand the inter-relationship between various air standard cycles used in gas power cycles.

Course Outcomes:

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

1. Apply the first law of thermodynamics for various energy systems
2. Analyze the performance of thermal engineering devices by using Second law of Thermodynamics.
3. Solve the properties of pure substances by using steam tables.
4. Calculate the P-V-T properties of gases and mixtures.
5. Analyze the Air standard cycles by using the thermodynamic principles

Unit 1 **Basic Concepts & First Law of Thermodynamics** **12**

System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Cycle – Reversibility, Quasi – static Process, Irreversible Process, Causes of Irreversibility – Energy in State and in Transition - Types, Work and Heat, Point and Path function.

Zeroth Law of Thermodynamics –Ideal Gas Scale – PMM I - Joule's Experiments – First law of Thermodynamics – Corollaries – First law applied to a Process – applied to a flow system – Steady Flow Energy Equation

Unit 2 **Second Law of Thermodynamics** **12**

Limitations of the First Law – Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance, Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries, PMM of Second kind, Carnot's principle, Carnot cycle and its specialties, Thermodynamic scale of Temperature.

Clausius Inequality, Entropy, Principle of Entropy Increase – Energy Equation, Availability and Irreversibility Elementary Treatment of the Third Law of Thermodynamics.

Unit 3 **Properties of Pure Substances** **10**

Pure Substances-, P-V-T- surfaces, T-S and h-s diagrams, Mollier Charts, Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation, Constructional use of Property tables. Mollier charts – Various Thermodynamic processes and energy Transfer – Steam Calorimetry.

Thermodynamic relations: -Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations.

Unit 4 **Perfect Gas Laws & Mixture Of Perfect Gases** **13**

Equation of State, specific and Universal Gas constants – various Non-flow processes, properties, end states, Heat and Work Transfer, changes in Internal Energy – Throttling and Free Expansion Processes – Flow processes – Deviations from perfect Gas Model – Vander Waals Equation of State – Compressibility charts – variable specific Heats – Gas Tables.

Mole Fraction, Mass fraction Gravimetric and volumetric Analysis – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes – Mole fraction, Volume fraction and partial pressure, Equivalent Gas constant and Molecular Internal Energy, Enthalpy, specific heats and Entropy of Mixture of perfect Gases and Vapour.

Unit 5 **Air Standard Cycles** **06**

Otto, Diesel and Dual cycles, P-V and T -S diagrams - Description and Efficiencies- Mean effective pressures. Comparison of Otto, Diesel and Dual cycles.

Prescribed Textbooks:

1. Engineering Thermodynamics. PK Nag, TMH, 6th edition,2017.
2. Thermodynamics – An Engineering Approach. Yunus Cengel& Boles, TMH. Mcgraw Higher Education 9th edition, 2019.

Reference Books:

1. Fundamentals of Thermodynamics. Sonntag, Borgnakke and Van wylen, John Wiley & sons (ASIA) Pt Ltd. Publisher: Wiley; 8 edition (December 26, 2012).
2. Thermodynamics. Mc Graw Hill J. P. Holman, McGraw-Hill College; 4th edition (January 1, 1988).
3. An introduction to Thermodynamics. YVC Rao, Universities Press, 3rd edition 2004.
4. Engineering Thermodynamics, Jones & Dugan, PHI INDIA (2011).
5. Basic Engineering Thermodynamics. A. Venkatesh, Universities Press; First edition (2007).

Web resources:

1. https://www.youtube.com/watch?v=9GMBpZZtjXM&list=PLD8E646BAB3366BC8
2. https://www.youtube.com/watch?v=pMmHdWvN_FI&list=PLyqSpQzTE6M_QOKxVxZ5nQ48gOkzg7zWP&index=1
3. https://www.youtube.com/watch?v=2LPQX4F-GoA&list=PLwdnzlV3ogoWV-_n1YItO933MxgPXfEiM
4. https://www.youtube.com/watch?v=ZXHbqJj5mk4&list=PLjA7uIhseb0-tML7elONaelFTts6xoG5B

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Engineering tool usage	The Engineer and the World	Ethics	Individual and Collaborative Team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
24AMEC31T .1	3	2	1	1	-	-	-	-	1	-	1	2	2
24AMEC31T .2	3	3	1	1	-	-	-	-	1	-	1	2	3
24AMEC31T .3	3	2	1	1	-	-	-	-	1	-	1	2	1
24AMEC31T .4	3	2	1	1	-	-	-	-	1	-	1	2	1
24AMEC31T .5	3	3	1	1	-	-	-	-	1	-	1	2	2

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RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course: Manufacturing Processes
Category: PC
Semester: III Semester
Course Code: 24AMEC32T
Branch/es: Mechanical Engineering

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

1. To know the working principle of different metal casting processes and gating system.
2. To classify the welding processes, working of different types of welding processes and welding defects.
3. To know the nature of plastic deformation, cold and hot working process, working of a rolling mill and types, extrusion processes.
4. To understand the principles of forging, tools and dies, working of forging processes.
5. To know about the Additive manufacturing and processing of plastics

Course Outcomes:

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

1. Explain casting processes, including pattern making, molding, solidification, and evaluate casting defects with appropriate remedies.
2. Analyze welding processes, joint characteristics, defects, their causes, and evaluate suitable remedies.
3. Analyze bulk forming processes, including metal behavior, and evaluate the effects of forging, rolling, and extrusion techniques.
4. Analyze sheet metal forming techniques, including deep drawing, bending, and evaluate defects and remedies in these processes
5. Explain additive manufacturing and plastic processing techniques, evaluate their advantages, limitations, and applications.

Unit 1 Casting & Special Casting Processes 08

Casting: Steps involved in making a casting – Advantage of casting and its applications. Patterns and Pattern making – Types of patterns – Materials used for patterns, pattern allowances and their construction, Molding, different types of cores, Principles of Gating, Risers, casting design considerations. Solidification of castings and casting defects- causes and remedies. Basic principles and applications of special casting processes - Centrifugal casting, Die casting, Investment casting and shell molding.

Unit 2 Welding Processes 08

Welding: Classification of welding processes, types of welded joints and their characteristics, Gas welding, Different types of flames and uses, Oxy – Acetylene Gas cutting.

Basic principles of Arc welding, power characteristics, Manual metal arc welding, submerged arc welding, TIG& MIG welding. Electro–slag welding. Resistance welding, Friction welding, Friction stir welding, Forge welding, Explosive welding; Thermit welding, Plasma Arc welding, Laser welding, electron beam welding, Soldering &Brazing. Heat affected zones in welding; pre & post heating, welding defects –causes and remedies

Unit 3 Bulk Metal Forming Processes 07

Bulk Forming: Plastic deformation in metals and alloys-recovery, recrystallization and grain growth. Hot working and Cold working - Strain hardening and Annealing. Bulk forming processes: Forging-Types of

Forging, forging defects and remedies; Rolling – fundamentals, types of rolling mills and products, Forces in rolling and power requirements. Extrusion and its characteristics. Types of extrusion, Impact extrusion, Hydrostatic extrusion; Wire drawing and Tube drawing.

Unit 4 Sheet Metal Forming Processes 06

Sheet metal forming-Blanking and piercing, Forces and power requirement in these operations, Deep drawing, stretch forming, Bending, spring back and its remedies, Coining, Spinning. High energy rate forming processes: Principles of explosive forming, electromagnetic forming, Electro hydraulic forming, rubber pad forming, advantages and limitations.

Unit 5 Additive Manufacturing and Polymer Processing Techniques 08

Additive manufacturing - Steps in Additive Manufacturing (AM), Classification of AM processes, Advantages of AM, and types of materials for AM, VAT photo polymerization AM Processes, Extrusion - Based AM Processes, Powder Bed Fusion AM Processes, Direct Energy Deposition AM Processes, Post Processing of AM Parts, Applications.

Plastics: Classification – Properties – Plastics as engineering materials – Method of processing plastics – Injection moulding –Blow moulding -extrusion compression and transfer moulding

Prescribed Textbooks:

1. S. Kalpakjian and S.R. Schmid, Manufacturing Engineering and Technology, Pearson Education, 2007, 7th Edition. ISBN-13- 978-9332587908
2. P.N. Rao, Manufacturing Technology: Volumes I, 5/e, McGraw Hill Education, 2018, ISBN-13-978-9353160500

Reference Books:

1. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, Wiley
2. Amitabha Ghosh and Asok Kumar Mallik, Manufacturing Science, Affiliated East-West Press
3. R.K. Rajput, Manufacturing Technology, Laxmi Publications
4. P.C. Sharma, A Textbook of Production Engineering, S. Chand & Company

Web Resources:

1. https://archive.nptel.ac.in/courses/112/107/112107219/
2. https://archive.nptel.ac.in/courses/112/107/112107145/
3. https://www.youtube.com/playlist?list=PLpW2AOg7zoagjrDiiUac0lSIEP734DwNj
4. https://www.youtube.com/watch?v=gvynYCsGh14
5. https://www.youtube.com/watch?v=iy-AuAC_hOg

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Engineering Tool usage	The Engineer and the World	Ethics	Individual and Collaborative team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
24AMEC32T.1	2	2	1	1	-	-	1	-	-	-	-	1	1
24AMEC32T.2	1	3	2	1	-	-	1	-	-	-	-	2	1
24AMEC32T.3	1	3	2	1	-	-	1	-	-	-	-	1	2
24AMEC32T.4	1	3	2	1	-	-	1	-	-	-	-	2	1
24AMEC32T.5	3	1	-	-	-	-	-	-	-	-	-	1	2

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RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course: Mechanics of Solids
Category: PC
Semester: III Semester
Course Code: 24AMEC33T
Branch/es: Mechanical Engineering

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

1. To understand the nature of stresses induced in material under different loads.
2. To plot the variation of shear force and bending moments over the beams under different types of loads.
3. To understand the behavior of beams subjected to bending and shear loads.
4. To calculate the deflection of beams under complex loading.
5. To analyze the thin and thick cylinders under circumferential and radial loading conditions.

Course Outcomes:

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

1. Solve for simple stresses and strains when members are subjected to load
2. Analyze Shear Force and Bending Moment in the beam subjected to different loading conditions.
3. Evaluate shear stresses and bending stresses in a beam subjected to different loading conditions.
4. Analyze the deflections in beam subjected to different loading conditions
5. Analyze thin cylindrical and spherical shell

Unit 1 Simple Stresses & Strains 09

Elasticity– Types of stresses & strains–Hooke's law– stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Elastic moduli & the relationship – Bars of varying section–composite bars (simple problems)–Thermal stresses (simple problems).Strain energy–Resilience, principal stresses and strains - Mohr's circle (Elementary treatment only) .

Unit 2 Shear Force and Bending Moment 08

Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, UDL, uniformly varying loads and combination – Point of contra flexure –Relation between S.F.,B.M and rate of loading at a section of a beam.

Unit 3 Bending Stresses & Shear Stresses 08

Flexural Stresses: Theory of simple bending – Assumptions – Derivation of bending equation: M/ I = f/y = E/R Neutral axis–Determination of bending stresses–section modulus of rectangular and circular sections (Solid and Hollow),I,T, Angle and Channel sections.

Shear Stresses: Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I,T and angle sections.

Unit 4 Deflection of Beams 09

Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam –Double integration and Macaulay's methods. Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, U.D.L, uniformly varying load.

Unit 5 Thin Cylinders & Thick Cylinders 07

Thin Cylinders: Thin seam less cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in diameter, and volume of thin cylinders.
Thick Cylinders: lame's equation – cylinders subjected to inside & outside pressures.

Prescribed Textbooks:

1. Strength of materials by S S Bhavikatti
2. Strength of Materials by S. Ramamrutham

Reference Books:

1. Strength of materials by R S Khurmi& N. Khurmi, S. Chand Publishing
2. S.B. Junnarkar, Mechanics of Structures Vol-III, Charotar publishing house.
3. S.Timoshenko, Strength of Materials, D Van Nostrand Company.
4. Strength of Materials by Dr. Sadhu Singh, ISBN: 978-81-7409-048-5,11th edition..
5. Strength of Materials by SS Rattan, Tata McGraw Hill Education Private Limited; 2nd edition (July 11, 2011)

Web Resources:

1. https://youtu.be/KMiz5UBCplk?si=iipl2kfLhiTP3HlY
2. https://youtu.be/Fui9Lxj3aJc?si=EmXJ9GRpD8oZaoek
3. https://youtu.be/SZM0kGBote4?si=j1yNQZk4TfxVBUKF
4. https://youtu.be/4TJ9DHueyxU?si=yK1neE_L6UvDBdcB
5. https://youtu.be/MvBqCeZllpQ?si=QexhXifAQ01Xb447
6. https://youtu.be/BUVqrefgHWk?si=REJDjtsAgbgmOF3D
7. https://youtu.be/UEmgT1JhMYs?si=S2rOGi1mwfeU3Ibp

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Engineering Tool usage	The Engineer and the World	Ethics	Individual and Collaborative team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
24AMEC33T.1	3	3	2	3	-	-	-	1	-	1	-	3	2
24AMEC33T.2	3	3	3	3	-	-	-	-	-	-	-	3	2
24AMEC33T.3	3	3	3	3	-	-	-	-	-	1	-	3	2
24AMEC33T 4	3	3	3	3	-	-	-	1	-	1	-	3	-
24AMEC33T.5	3	3	3	3	-	-	-	1	-	-	-	3	2

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RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course: Material Science and Metallurgy
Category: PC
Semester: III Semester
Course Code: 24AMEC34T
Branch/es: Mechanical Engineering

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

1. To understand the mechanism of crystallization, imperfections in crystals & factors affecting solid solubility.
2. To study the stability of phases in different alloy systems.
3. To acquire knowledge on properties and structure of ferrous and nonferrous alloys and to select suitable materials for various engineering applications.
4. To learn various methods of heat treatment and surface hardening.
5. To gain knowledge on properties and applications of ceramic, composites & other advanced materials.

Course Outcomes:

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

1. Summarize the crystallization of metals and factors affecting the solid solubility.
2. Analyze the phase diagrams of binary systems and iron-carbide diagram to identify the material composition depending on the design requirements.
3. Summarize the structure, properties and applications of various cast irons, steels and non-ferrous alloys.
4. Apply the various heat treatment processes, surface hardening methods depending on material requirements and summarize the steel making processes.
5. Summarize the concepts of powder metallurgy and properties, applications of ceramic, composites.

Unit 1 Structure of Metals and Constitution of alloys 06

Structure of Metals and Constitution of alloys: Crystallization of metals, Packing Factor - SC, BCC, FCC & HCP. Grain and grain boundaries, effect of grain boundaries – determination of grain size.

Imperfections, Slip and Twinning. Necessity of alloying, types of solid solutions, Hume Rothery's rules, intermediate alloy phases, and electron compounds.

Unit 2 Equilibrium Diagrams 08

Equilibrium Diagrams: Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of binary phase diagrams such as Cu-Ni and Fe-Fe_3C.

Unit 3 Ferrous metals and alloys 07

Ferrous metals and alloys: Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheroidal graphite cast iron, Alloy cast iron. Classification of steels, structure and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels.

Non-ferrous Metals and Alloys: Structure and properties of copper and its alloys, Aluminium and its alloys, Titanium and its alloys, Magnesium and its alloys. Super alloys and Shape memory alloys – properties and applications.

Unit 4 Heat treatment of Steels & Metallurgy 07

Heat treatment of Steels: Effect of alloying elements on Fe-Fe3C system, annealing, normalizing, hardening, TTT diagrams, tempering, hardenability, surface - hardening methods, age hardening treatment, Cryogenic treatment.

Metallurgy: Steel Making - Introduction, Methods of steelmaking – crucible process, Bessemer converter process, Open Hearth Process.

Unit 5 Powder Metallurgy & Ceramics and Composite Materials 07

Powder Metallurgy: Basic processes- Methods of producing metal powders- milling atomization-Granulation-Reduction-Electrolytic Deposition. Compacting methods – Sintering - Methods of manufacturing sintered parts. Secondary operations, Applications of powder metallurgical products.

Ceramics and Composite materials: Crystalline ceramics, glasses, cermets, abrasive materials, Classification of composites, manufacturing methods, particle reinforced composites, fiber reinforced composites, PMC, MMC, CMC and CCCs.

Prescribed Textbooks:

1. Dr. V. D. Kodgire, Material Science and Metallurgy for Engineers, 39/e, Everest Publishing House, 2024, ISBN-13: 978-8176314008
2. O.P. Khanna, A Textbook of Material Science And Metallurgy, Dhanpat Rai Publications, 2010, ISBN-13-978-8189928315

Reference Books:

1. S. H. Avner, Introduction to Physical Metallurgy, 2/e, Tata McGraw- Hill, 1997.
2. William D. Callister Jr, Materials Science Engineering: An Introduction, 8/e, John Wiley and Sons, 2009.
3. Donald R. Askeland, Essentials of Materials science Engineering, 4/e, CL Engineering publications, 2018.
4. George E. Dieter, Mechanical Metallurgy, 3/e, McGraw-Hill, 2013.
5. Yip-Wah Chung, Introduction to Material Science and Engineering, 2/e, CRC Press, 2022.

Web Resources:

1. https://archive.nptel.ac.in/courses/113/102/113102080/
2. https://www.youtube.com/watch?v=5vaYfd0fekI
3. https://www.youtube.com/watch?v=zwnblxXyERE
4. https://www.youtube.com/watch?v=ET5igG-Gm30
5. https://archive.nptel.ac.in/courses/113/106/113106098/

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Engineering Tool usage	The Engineer and the World	Ethics	Individual and Collaborative team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
24AMEC34T.1	2	1	1	1	-	-	-	-	-	-	-	1	2
24AMEC34T.2	1	3	1	1	-	-	-	-	-	-	-	2	1
24AMEC34T.3	2	1	1	1	-	-	-	-	-	-	-	1	2
24AMEC34T.4	3	2	1	1	-	-	-	-	-	-	-	2	1
24AMEC34T.5	2	1	1	1	-	-	-	-	-	-	-	1	2

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(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course: **Mechanics of Solids and Materials Science Lab**
Category: PC (LAB)
Semester: III Semester
Course Code: 24AMEC35L
Branch/es: Mechanical Engineering

Lecture Hours	Tutorial Hours	Practice Hours	Credits
-	-	3	1.5

Course Objectives:

1. To evaluate the values of yield stress, ultimate stress and bending stress of the given specimen under tension test and bending test.
2. To conduct the torsion test to determine the modulus of rigidity of given specimen.
3. To Justify the Rockwell hardness test over with Brinell hardness and measure the hardness of the given specimen.
4. To examine the stiffness of the open coil and closed coil spring and grade them.
5. To analyze the microstructure and characteristics of ferrous and nonferrous alloy specimens.
6. To calculate the hardenability by jominy & quench apparatus.

Course Outcomes:

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

1. Analyze the stress strain behavior of different materials.
2. Evaluate the hardness of different materials.
3. Explain the relation between elastic constants and hardness of materials.
4. Identify various microstructures of steels and cast irons.
5. Evaluate hardness of treated and untreated steels.

List of Experiments:

Mechanics of Solids Laboratory

1. Direct tension test
2. Torsion test
3. Hardness test a) Brinell hardness test b) Rockwell hardness test
4. Test on springs
5. Compression test on wood
6. Impact test a) Charpy test b) Izod test
7. Shear test
8. Wear Test
9. Vickers Hardness Test
10. Deflection of beams
11. Liquid penetration test

Note: Need to perform any 8 Experiments

Material science Laboratory

1. Study of Microstructures of Pure Metals – Copper & Aluminium.
2. Study of Microstructures of Non – Ferrous Alloy – Brass.
3. Study of Microstructures of Other Alloys – Stainless Steel, Case Carburized Steel & Bearing Metal.
4. Study of Microstructures of Cast Irons – Gray, Malleable & White Cast Irons.
5. Study of Microstructures of Low Carbon Steel & Medium Carbon Steel.

6. Study of Microstructures of Heat-Treated Steels.
7. Finding out the Hardness of Treated and Untreated Steels.
8. Finding out the Hardenability of Steels by using Jominy End Quench Test Apparatus.

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Engineering Tool usage	The Engineer and the World	Ethics	Individual and Collaborative team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
24AMEC35L.1	3	-	-	3	-	-	-	-	-	-	-	1	2
24AMEC35L.2	3	-	-	3	-	-	-	-	-	-	-	1	2
24AMEC35L.3	3	-	-	3	-	-	-	-	-	-	-	1	2
24AMEC35L.4	3	3	-	3	-	-	1	3	-	3	3	2	2
24AMEC35L.5	3	3	-	3	-	-	1	3	-	3	3	2	2

ANNAMACHARYA UNIVERSITY

(ESTD UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT, 2016)

(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course: Manufacturing Processes Lab
Category: PC (LAB)
Semester: III Semester
Course Code: 24AMEC32L
Branch/es: Mechanical Engineering

Lecture Hours	Tutorial Hours	Practice Hours	Credits
-	-	3	1.5

Course Objectives:

1. To acquire practical knowledge on making of patterns and calculation of its allowances, preparation of mould cavity and casting.
2. To impart hands on practical exposure of joining of metals by welding process and its heat affected zone on weldments.
3. To acquire practical knowledge of joining thin metals by spot welding, joining of metals by TIG welding and Gas welding processes.

Course Outcomes:

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

1. Make Pattern with pattern material selection and pattern allowances.
2. Find sand properties and apply in sand preparation for casting process.
3. Fabricate components using primary manufacturing processes such as casting, welding, joining and forming.
4. Acquire knowledge about the various tools, equipment, machinery and operations required for mechanical press working manufacturing processes.
5. Make the components by processing of plastics using injection and blow moulding.

List of Experiments

Casting:

1. Pattern Design and making
2. Sand properties testing - Exercise -for strengths, and permeability – 2 Experiments
3. (i) Casting preparation. (ii) Identification of casting defects.

Welding:

1. ARC Welding Lap & Butt Joint - 2 Experiments.
2. Spot Welding - 1 Experiment.
3. TIG Welding - 1 Experiment.
4. Plasma welding and Brazing - 2 Exercises (Water Plasma Device).

Mechanical Press Working:

1. Blanking & Piercing operation and study of simple, compound and progressive press tool.
2. Hydraulic Press: Deep drawing and extrusion operation.
3. Bending and other operations.

Processing of Plastics:

1. Injection Moulding.
2. Blow Moulding.

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Modern tool usage	The Engineer and the World	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
24AMEC32L.1	3	3	3	3	-	-	-	3	1	-	1	2	2
24AMEC32L.2	3	2	1	3	2	-	-	3	1	-	1	1	1
24AMEC32L.3	3	2	1	1	2	-	-	3	-	-	1	2	2
24AMEC32L.4	3	2	1	1	2	-	-	3	-	-	1	2	2
24AMEC32L,5	3	2	1	1	2	-	-	3	-	-	1	2	2

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(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course: Computer-Aided Drafting and Design (with AutoCAD & CATIA)
Category: SEC
Semester: III Semester
Course Code: 24AMEC36T
Branch/es: Mechanical Engineering

Lecture Hours	Tutorial Hours	Practice Hours	Credits
1	-	2	2

Course Objectives:

1. To familiarize students with basic and advanced 2D drafting techniques using AutoCAD.
2. To enable students to create mechanical joints and machine components using standard conventions.
3. To introduce 3D modeling, part design, and assembly creation using CATIA software

Course Outcomes:

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

1. Develop detailed technical drawings in AutoCAD, including proper dimensions, labels, and conventions for mechanical parts.
2. Utilize AutoCAD tools to draw and modify mechanical diagrams, applying commands such as Array, Ellipse, and Direct Distance Entry.
3. Create 2D mechanical drawings in AutoCAD, including basic shapes and common mechanical joints like bolts, rivets, and welds.
4. Create 3D parts in CATIA, such as machine components like a Screw Jack, Stuffing Box, Knuckle Joints or Steam Engine Crossheads.
5. Assemble the mechanical systems in CATIA by applying constraints and simulating the interactions of components, such as Screw Jack, Stuffing Box, Knuckle Joints or Steam Engine Crossheads.

Course Content:

Introduction to AutoCAD: Basic drawing and editing commands: line, circle, rectangle, erase, view, undo, redo, snap, object editing, moving, copying, rotating, scaling, mirroring, layers, templates, polylines, trimming, extending, stretching, fillets, arrays, dimensions. Dimensioning principles and conventional representations.

Part A: Drafting of Engineering and Machine Drawing Components using AutoCAD

List of Exercises:

(Note: Any six out of the eight exercises listed below can be performed.)

1. Drawing basic 2D shapes: Square, Pentagon, Circle, and n-sided Polygon.
2. Creating line diagrams using:
   - Absolute Coordinate Method
   - Relative Polar Coordinate Method
3. Drawing using advanced tools: Donut, Ellipse, Rectangular and Polar Array.
4. Conversion of isometric to orthographic views using Direct Distance Entry.
5. Detachable joints: Drawing hexagonal and square-headed bolts and nuts, bolted joint with washer and locknut.
6. Riveted joints: Drawing rivets, lap joints, butt joints with single/double straps, single/double riveting.
7. Welded joints: Drawing T-joint, lap joint, and butt joint with standard conventions.
8. Keys: Drawing saddle key, feather key, and round key.

Course Content:
Introduction to CATIA interface, sketching tools, and basic constraints. 3D part modeling using Pad, Pocket, Shaft, Hole, Fillet, and Chamfer. Assembly creation with constraints to build mechanical assemblies. 2D drafting from 3D models with dimensions and annotations.

Part B: Drafting and Visualization of 3D Mechanical Components and Assemblies using CATIA
List of Exercises:
(Note: Any three out of the four assembly exercises listed below can be performed.)

1. Hands-on practice in CATIA interface and Sketcher module – Practicing basic 2D profiles and shapes to build familiarity with the modeling environment (minimum of 6 sketches).
2. Creation of 3D part models of mechanical components (e.g., bolt, nut, shaft, flange, cotter, etc.) using CATIA part design features such as Pad, Pocket, Shaft, and Groove.
3. Knuckle Joint Assembly – Modeling and assembling the individual parts of a Knuckle Joint with proper constraints and ensuring functional movement.
4. Screw Jack Assembly – Creating and assembling the parts of a Screw Jack, ensuring the assembly works with functional motion.
5. Stuffing Box Assembly – Modeling and assembling the Stuffing Box components for sealing and mechanical interaction.
6. Steam Engine Crosshead Assembly – Assembling the individual parts of a Steam Engine Crosshead, including components like the crosshead, piston, and connecting rods.

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Engineering Tool usage	The Engineer and the World	Ethics	Individual and Collaborative team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
24AMEC36T.1	3	2	2	-	3	-	-	-	1	1	2	3	2
24AMEC36T.2	2	2	2	-	3	-	-	-	1	1	2	3	2
24AMEC36T.3	2	2	2	-	3	-	-	-	1	1	2	3	2
24AMEC36T.4	3	2	3	2	3	-	-	-	2	2	2	3	3
24AMEC36T.5	3	3	3	3	3	-	-	-	2	2	3	3	3

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(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course:	Environmental Science
Category:	MC
Semester:	III Semester
Course Code:	24AENS31T
Branches:	CSE, CSE(AIML), CSE(IOT), EEE, ME

Lecture Hours	Tutorial Hours	Practice Hours	Credits
2	-	-	-

Course Objectives: This course aims to raise environmental awareness, promote sustainable practices aligned with the Sustainable Development Goals (SDGs), and highlight the significance of ecosystems and biodiversity. It sensitizes students to major pollution issues and related legislative measures, fosters ethical responsibility and problem-solving skills to tackle environmental challenges, and explains the impact of human population growth on the environment and public health. The course also emphasizes the role of education, information technology, and public policy in promoting environmental sustainability.

Course Outcomes:

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

1. explain how natural resources should be utilised with a focus on sustainability.
2. describe the need to protect ecosystems and biodiversity for future generations.
3. comprehend major pollution problems related to ecosystems.
4. Summarize key environmental issues, sustainable practices, and laws supporting environmental protection in the context of sustainable development goals.
5. explain the effects of population growth on environment and health, and the role of education, IT, and welfare programs in managing them.

Unit 1 Natural resources **7**

Natural Resources: Renewable and non-renewable resources – Forest resources: Uses, deforestation – Water resources: Uses, floods, drought – Mineral resources: Uses, environmental effects of extracting mineral resources– Energy resources: Renewable and non-renewable energy sources (overview only).

Unit 2 Ecosystems, Biodiversity and its conservation **6**

Ecosystems: Producers, consumers and decomposers – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and functions of the following ecosystems: Forest ecosystem and lake ecosystem.

Biodiversity and its conservation: Definition – Values of biodiversity – Hot-spots of biodiversity – Threats to biodiversity – Conservation of biodiversity.

Unit 3 Environmental pollution **5**

Definition, causes, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards.

Self-learning: Genetically modified crops

Unit 4 Social issues and the Environment **6**

Sustainable development – Rainwater harvesting – Environmental ethics – Climate change, global warming, acid rain, ozone layer depletion – Air (Prevention and Control of Pollution) Act – Water (Prevention and Control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Environment Protection Act.

Unit 5 Human population and the Environment **6**

Population explosion – Family welfare programmes – Environment and human health – Value education – Role of information technology in environment and human health, Field work – Visit to a local area to document environmental assets.

Prescribed Textbooks:

1. Kaushik, Anubha, and C. P. Kaushik. *Perspectives in Environmental Studies*. 7th ed., New Age International Publishers, 2022.
2. Chawla, Shashi. *A Textbook of Environmental Studies*. 1st ed., McGraw Hill Education, 2017.

Reference Books:

1. Joseph, Benny. *Environmental Studies*. 3rd ed., McGraw Hill Education India, 2017.
2. Dhinakaran, A., and Sankaran, B. *A Textbook of Environmental Studies*. 1st ed., Himalaya Publishing House, 2023.
3. Basu, Mahua, and Xavier, S. *Fundamentals of Environmental Studies*. 1st ed., Cambridge University Press, 2017.
4. Bharucha, Erach. *Textbook of Environmental Studies for Undergraduate Courses*. 3rd ed., Universities Press (India), 2021.
5. Tiwari, Vijay Kumar. *A Textbook of Environmental Studies*. 1st ed., Himalaya Publishing House, 2024.

CO-PO Mapping:

Course outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Engineering tool usage	The Engineer and the World	Ethics	Individual and collaborative teamwork	Communication	Project management and finance	Life-long learning
24AENS31T.1	2	2	-	-	-	-	2	-	-	-	2
24AENS31T.2	2	2	-	-	-	-	2	-	-	-	2
24AENS31T.3	2	2	-	-	-	-	2	-	-	-	2
24AENS31T.4	3	2	-	-	-	-	2	-	-	-	3
24AENS31T.5	2	2	-	-	-	-	2	-	-	-	2

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(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course: Industrial Management
Category: HSM
Semester: IV Semester
Course Code: 24AMEC41T
Branch/es: Mechanical Engineering

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

1. To introduce the scope and role of industrial engineering and the techniques for optimal design of layouts
2. To illustrate how work study is used to improve productivity and project management techniques
3. To explain TQM and quality control techniques.
4. To introduce financial and marketing management aspects.
5. To discuss human resource management and value analysis

Course Outcomes:

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

1. Describe the principles and functions of management & Plant layouts.
2. Apply work study methods and project management concepts at Industrial level.
3. Analyze data using control charts to monitor, improve quality and inventory control.
4. Describe various sources of finance, marketing and their implications.
5. Describe human resource management methods.

Unit 1 Introduction & Plant Layout 08

Introduction: Definition of industrial engineering (I.E), development, applications, role of an industrial engineer, differences between production management and industrial engineering, productivity measurement. concepts of management, importance, functions of management, scientific management, Taylor's principles, Fayol's principles of management.

PLANT LAYOUT: Factors governing plant location, types of production, types of layouts, advantages and disadvantages of process layout and product layout, Fixed position layout, applications.

Unit 2 Work Study & Project Management 07

Work Study: Importance, applications, work study, method study and time study(elementary treatment), work sampling, PMTS, micro-motion study, rating techniques, MTM, flow process charts, string diagrams and Therbligs.

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

Unit 3 Statistical Quality Control & Total Quality Management 07

Statistical Quality Control: Quality control, and its importance, SQC, attribute sampling inspection with single and double sampling, Control charts X and R charts and their applications, simple numerical examples. Inventory, types of Inventories, Inventory control, EOQ, Inventory control techniques, ABC, VED, FSN, SOS, GOLF Analysis.

Total Quality Management: Elements of TQM – Continuous Improvement zero defect concept, quality circles, implementation, applications, ISO quality systems. Six Sigma–definition, basic concepts

Unit 4 Financial Management & Marketing 07

Financial Management: Scope and nature of financial management, Sources of finance, Ratio analysis, Management of working capital, Nature of Investment Decisions – Investment Evaluation criteria- NPV, IRR, PI, Payback Period, and ARR, numerical problems.

Marketing: Functions of Marketing, Marketing Mix, and Marketing Strategies based on Product Life Cycle, Channels of distribution.

Unit 5 Human Resource Management & Value Analysis 06

Human Resource Management: Concept of human resource management, personnel management and industrial relations, functions of personnel management, Job-evaluation, its importance and types, merit rating, quantitative methods, wage incentive plans, and types.

Value Analysis: Value engineering, implementation procedure, enterprise resource planning and supply chain management

Prescribed Textbooks:

1. O.P Khanna, Industrial Engineering and Management, Dhanpat Rai Publications (P) Ltd, 2018
2. Martand Telsang, Industrial Engineering and Production Management, S.Chand & Company Ltd. New Delhi, 2006

Reference Books:

1. M.Mahajan Industrial Engineering and Production Management, Dhanpat Rai & Co (P) Ltd, 2000
2. Bhattacharya DK, Industrial Management, S.Chand, publishers, 2010
3. J.G Monks, Operations Management, 3/e, McGraw Hill Publishers1987
4. T.R. Banga, S.C.Sharma, N. K. Agarwal, Industrial Engineering and Management Science, Khanna Publishers, 2008
5. Koontz O'Donnell, Principles of Management, 4/e, McGraw Hill Publishers, 1968
6. R.C.Gupta, Statistical Quality Control, Khanna Publishers, 1998

Web Resources:

1. https://www.youtube.com/watch?v=ckiMUG2imuM
2. https://youtu.be/4vq0FKWYud8
3. https://youtu.be/zdLWc9zs77Q
4. https://youtu.be/-TDh-5n90vk
5. https://youtu.be/BWbnKgFNcKg

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Engineering Tool usage	The Engineer and the World	Ethics	Individual and Collaborative team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
24AMEC41T.1	2	2	2	2	-	-	-	-	-	-	-	2	2
24AMEC41T.2	3	2	2	2	-	-	-	-	-	-	-	1	1
24AMEC41T.3	2	2	2	2	-	-	-	-	-	-	-	1	1
24AMEC41T.4	3	2	2	2	-	-	-	-	-	-	-	2	2
24AMEC41T.5	2	2	2	2	-	-	-	-	-	-	-	2	2

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(ESTD UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT, 2016)
(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)
RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course: Probability and Statistics
Category: BS
Semester: IV Semester
Course Code: 24AMAT41T
Branch/es: CE, ME, CSE, AIDS, AIML, CSE(AI), CSE(DS), CSE(AIML), CSE(IOT)

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:
The course aims to build a strong foundation in probability and statistics for modeling and analyzing data under uncertainty. It covers probability theorems, random variables, distributions, correlation, estimation, and hypothesis testing for large and small samples. Students will gain the ability to apply statistical tools in data analysis, research, and engineering problem-solving.

Course Outcomes:
At the end of the course, the student will be able to
1. Apply the concepts of probability theorems in stochastic process
2. Apply the probability distribution in real life problems
3. Calculate the correlation between two variables
4. Evaluate the hypotheses of large samples
5. Evaluate the hypotheses of small samples

Unit 1 Probability **10**
Probability - axioms of probability – addition theorem of probability - conditional probability-multiplication theorem of probability (without proof) - Baye's theorem.
Random variables - discrete and continuous - Distribution functions - Mean and Variance.

Unit 2 Probability distributions **08**
Probability distributions – Binomial and Poisson distribution - fitting - normal distribution - their properties.

Unit 3 Introduction of statistics **08**
Introduction of Statistics – Mean - Median and Mode for ungrouped and grouped data.
Correlation - correlation coefficient: Karl Pearson's coefficient - Spearman's rank correlation.

Unit 4 Estimation and Testing of hypothesis for large samples **10**
Estimation - Point estimation - Interval estimation of one mean (small and large) - one Proportion (large).
Test of Hypothesis: Types of errors, one and two tailed tests, level of significance, single mean -difference of means - single proportion - difference of proportions (large).

Unit 5 Testing of hypothesis for small samples **08**
Student t-distribution test for single mean - two means and paired t-test,
Testing of equality of variances (F-test) - χ^2 test for goodness of fit - χ^2 test for independence of attributes.

Prescribed Textbooks:

1. Miller and Freund, Probability and Statistics for Engineers,7/e, Pearson, 2008.
2. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.

Reference Books:

1. S. Ross, a First Course in Probability, Pearson Education India, 2002.
2. W. Feller, an Introduction to Probability Theory and its Applications, 1/e, Wiley, 1968.
3. T. K.V. Iyengar, B. Krishna Gandhi, S. Ranganatham and M.V.S.S.N. Prasad, Probability and Statistics, 2nd edition, S. Chand, 2010.

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Engineering tool usage	The Engineer and the World	Ethics	Individual and Collaborative team work	Communication	Project management and finance	Life-long learning
24AMAT41T.1	3	2	1	2	-	-	-	-	-	-	-
24AMAT41T.2	3	2	1	2	-	-	-	-	-	-	-
24AMAT41T.3	3	2	1	2	-	-	-	-	-	-	-
24AMAT41T.4	3	3	1	2	-	-	-	-	-	-	-
24AMAT41T.5	3	3	1	2	-	-	-	-	-	-	-

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(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course: Universal Human Values-II
Category: HSM
Semester: IV Semester
Course Code: 24AUHV41T
Branch/es: ME, CSE, CSE(ICB)

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

1. To recognize the vital interplay between values and skills, promoting sustained happiness and prosperity
2. To foster a holistic perspective on life and profession, encouraging value-based living through a clear understanding of human reality and existence
3. To emphasizes the ethical implications of such an understanding, fostering trustful behaviour, fulfilling human interactions, and a harmonious relationship with nature.

Course Outcomes:

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

1. Comprehend the terms like Natural Acceptance, Happiness and Prosperity.
2. Analyze one's self, and one's surroundings (family, society, nature).
3. Apply human values in enriching human relationships and human society.
4. Analyze the need for universal human values and harmonious existence.
5. Evaluate themselves as socially and ecologically responsible engineers.

Unit 1 Introduction to Value Education 12

Lecture1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)
Lecture2: Understanding Value Education
Tutorial 1: Practice Session1: Sharing about oneself
Lecture 3: Self-Exploration as the Process for Value Education
Lecture4: Continuous Happiness and Prosperity – The Basic Human Aspirations
Tutorial 2: Practice Session2: Exploring Human Consciousness
Lecture 5: Happiness and Prosperity – Current Scenario
Lecture 6: Method to Fulfill the Basic Human Aspirations
Tutorial 3: Practice Session3: Exploring Natural Acceptance

Unit 2 Harmony in the Human Being 08

Lecture 7: Understanding Human being as the co-existence of the self and the body.
Lecture 8: Distinguishing between the needs of the self and the body
Tutorial 4: Practice Session4: Exploring the difference of needs of self and body.
Lecture 9: The body as an instrument of the self
Lecture 10: Understanding harmony in the self
Tutorial 5: Practice Session5: Exploring sources of imagination in the self
Lecture 11: Harmony of the self with the body
Lecture 12: Programme to ensure self-regulation and health
Tutorial 6: Practice Session 6: Exploring harmony of self with the body

Unit 3 Harmony in the Family and Society 08

Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction

Lecture 14: 'Trust' – the Foundational Value in Relationship
Tutorial 7: Practice Session7: Exploring the Feeling of Trust
Lecture 15: 'Respect' – as the Right Evaluation
Tutorial 8: Practice Session 8: Exploring the Feeling of Respect
Lecture 16: Other Feelings, Justice in Human-to-Human Relationship
Lecture 17: Understanding Harmony in the Society
Lecture 18: Vision for the Universal Human Order
Tutorial 9: Practice Session9: Exploring systems to fulfil human goal

Unit 4 Harmony in the Nature/Existence 10

Lecture 19: Understanding Harmony in the Nature
Lecture 20: Interconnectedness, Self-Regulation and Mutual Fulfilment among the Four Orders of Nature
Tutorial 10: Practice Session 10: Exploring the Four Orders of Nature
Lecture 21: Realizing Existence as Co-existence at All Levels
Lecture 22: The Holistic Perception of Harmony in Existence
Tutorial 11: Practice Session11: Exploring Co-existence in Existence

Unit 5 Implications of the Holistic Understanding – A Look at Professional Ethics 10

Lecture 23: Natural Acceptance of Human Values
Lecture 24: Definitiveness of (Ethical) Human Conduct
Tutorial 12: Practice Session 12: Exploring Ethical Human Conduct
Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order
Lecture 26: Competence in Professional Ethics
Tutorial 13: Practice Session13: Exploring Humanistic Models in Education
Lecture 27: Holistic Technologies, Production Systems and Management
Models-Typical Case Studies
Lecture 28: Strategies for Transition towards Value-based Life and Profession
Tutorial 14: Practice Session14: Exploring Steps of Transition towards Universal Human Order

Practice Sessions for UNIT I – Introduction to Value Education
PS1 Sharing about Oneself
PS2 Exploring Human Consciousness
PS3 Exploring Natural Acceptance
Practice Sessions for UNIT II – Harmony in the Human Being
PS4 Exploring the Difference of Needs of Self and Body
PS5 Exploring Sources of Imagination in the Self
PS6 Exploring Harmony of Self with the Body
Practice Sessions for UNIT III – Harmony in the Family and Society
PS7 Exploring the Feeling of Trust
PS8 Exploring the Feeling of Respect
PS9 Exploring Systems to fulfil Human Goal
Practice Sessions for UNIT IV – Harmony in the Nature (Existence)
PS10 Exploring the Four Orders of Nature
PS11 Exploring Co-existence in Existence
Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics
PS12 Exploring Ethical Human Conduct
PS13 Exploring Humanistic Models in Education
PS14 Exploring Steps of Transition towards Universal Human Order

Prescribed Textbooks:

1. The Textbook - R R Gaur, R Asthana, G P Bagaria. A Foundation Course in Human Values and Professional Ethics. 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1.

2. The Teacher's Manual - R R Gaur, R Asthana, G P Bagaria. Teachers' Manual for A Foundation Course in Human Values and Professional Ethics. 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books:

1. A. Nagaraj. *Jeevan Vidya: Ek Parichaya.* Jeevan Vidya Prakashan, Amarkantak, 1999.
2. A.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. F Schumacher. *Small is Beautiful*

Web Resources:

1. https://fdp-si.aicte-india.org/UHV- II%20Class%20Notes%20&%20 Handouts/UHV%20Handout%201Introduction%20to%20Value%20Education.pdf
2. https://fdp-si.aicte-india.org/UHV- II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf
3. https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3S2%20Respect%20July%2023.pdf
4. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf
5. https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%202325%20Ethics%20v1.pdf
6. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-humanvalues/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385https://onlinecourses.swayam2.ac.in/aic22_ge23/preview
7. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf

CO-PO Mapping:

Course outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Engineering tool usage	The Engineer and the World	Ethics	Individual and collaborative teamwork	Communication	Project management and finance	Life-long learning
24AUHV41T.1	-	-	-	-	-	-	3	-	1	-	2
24AUHV41T.2	-	-	-	-	-	-	3	-	1	-	2
24AUHV41T.3	-	-	-	-	-	-	3	-	1	-	2
24AUHV41T.4	-	-	-	-	-	-	3	-	1	-	3
24AUHV41T.5	-	-	-	-	-	2	3	-	1	-	2

ANNAMACHARYA UNIVERSITY

(ESTD UNDER AP PRIVATE UNIVERSITIES (ESTABLISHMENT AND REGULATION) ACT, 2016)
(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course: Fluid Mechanics and Hydraulic Machines
Category: PC
Semester: IV Semester
Course Code: 24AMEC42T
Branch/es: Mechanical Engineering

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

1. To impart the knowledge of fluid statics and kinematics.
2. To gain knowledge on fluid dynamics.
3. To understand the Hydro Electric power plant and importance of impact of jet on vanes.
4. To familiarize about different types of turbines and their performance characteristics.
5. To acquire knowledge on pumps and their performance characteristics.

Course Outcomes:

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

1. Solve the problems on properties of fluids under static and kinematic conditions.
2. Calculate the properties of fluids and losses in pipes under dynamic conditions.
3. Calculate the force exerted by the jet on vanes at different positions.
4. Solve the problems on performance parameters of different turbines.
5. Calculate the performance of the different types of Hydraulic Pumps.

Unit 1 Fluid Statics & Fluid Kinematics 10

Dimensions and units: physical properties of fluids- specific gravity, viscosity, Newton's law of viscosity and surface tension vapour pressure - atmospheric gauge and vacuum pressure – measurement of pressure Piezometer, U-tube and differential manometers – Buoyancy (elementary treatment).

Fluid Kinematics: Stream line, path line, streak lines and stream tube, classification of flows-steady & unsteady, uniform & non uniform, laminar & turbulent, rotational & irrotational flows. Equation of continuity for one dimensional flow.

Unit 2 Fluid Dynamics & Closed Conduit Flow 08

Surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, Applications of Bernoulli's equations- Measurement of flow: Pitot tube, Venturi meter and orifice meter. Momentum equation and its application on force on pipe bend. Vortex flow-Free and forced (Elementary Treatment).

Closed Conduit Flow: Reynold's experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel.

Unit 3 Boundary Layer 08

Introduction, momentum integral equation, displacement, momentum and energy thickness, separation of boundary layer.

Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.

Unit 4 Hydraulic Turbines 10

Classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design –draft tube theory- functions and efficiency.

Performance of Hydraulic Turbines: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, water hammer.

Unit 5 Hydraulic Pumps **11**

Classification of pumps. Centrifugal pumps: Working, work done – manometric head, losses and efficiencies, specific speed, pumps in series and parallel. Performance - characteristic curves, NPSH.
Reciprocating Pumps: Working, Discharge, slip, ideal indicator diagram.

Prescribed Textbooks:

1. Fluid Mechanics and Hydraulic machines by Dr. R.K. Bansal latest edition November 2023
2. Hydraulics and Fluid Mechanics including Hydraulic Machines by Dr. P.N. Modi and Dr. S.M. Seth latest edition January 2019

Reference Books:

1. D.S. Kumar, Fluid Mechanics and Fluid Power Engineering. Kotaria & Sons – 2013 edition
2. D. Rama Durgaiah, Fluid Mechanics and Machinery. New Age International, 1st edition – 2002
3. Banga & Sharma, Hydraulic Machines. Khanna Publishers.
4. James W. Dally, William E. Riley, Instrumentation for Engineering Measurements. John Wiley & Sons Inc, 2nd edition – 2010

Web Resources:

1. https://www.youtube.com/watch?v=whCu4Xl3m98
2. https://www.youtube.com/watch?v=DW4rItB20h4
3. https://www.youtube.com/watch?v=GgVCTNCwfQk
4. https://www.youtube.com/watch?v=GQHCnWl2U6I
5. https://www.youtube.com/watch?v=LCzIk0VDVQc

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Modern tool usage	The Engineer and the World	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
24AMEC42T.1	3	2	2	2	-	-	-	-	-	-	-	2	2
24AMEC42T.2	3	2	2	2	-	-	-	-	-	-	-	1	2
24AMEC42T.3	3	2	2	2	-	-	-	-	-	-	-	2	2
24AMEC42T.4	3	2	3	2	-	-	-	-	-	-	1	2	2
24AMEC42T.5	3	2	3	2	-	-	-	-	-	-	1	2	2

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(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)
RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course: Theory of Machines
Category: PC
Semester: IV Semester
Course Code: 24AMEC43T
Branch/es: Mechanical Engineering

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

1. To know the various basics related to simple mechanisms and their inversions.
2. To understand the velocity and acceleration in simple mechanisms and also effects of gyroscopic couple.
3. To familiarize the different gears and gear trains.
4. To apply the different balancing methods for rotating and reciprocating masses.
5. To understand the different vibrations and its natural frequencies for single degree of freedom system.

Course Outcomes:

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

1. Analyze different mechanisms, inversions of different kinematic chains and mobility of mechanisms
2. Analyze the velocity and acceleration diagrams of simple plane mechanisms by using relative velocity method and understand the effects of gyroscopic principle.
3. Analyze the phenomenon of interference in gears and velocity ratio of gear trains.
4. Estimate the balancing masses for rotating and reciprocating members in automotive applications.
5. Analyze the natural frequencies of mechanical systems based on governing equations.

Unit 1 Simple Mechanisms 09

Kinematic Link-Types of Links-Types of constraint motions-Classification of Kinematic Pairs – Kinematic Chain-Degree of freedom – Grashof's Law-Inversions of four bar chain, single and double slider crank mechanisms- Description of straight-line mechanisms – Peacellier and Harts mechanism- Steering gear mechanism: Ackerman, Davis steering mechanisms.

Unit 2 Velocity and Acceleration analysis, Gyroscope 10

Velocity and Acceleration analysis: Velocity analysis of simple mechanisms using relative velocity method-rubbing velocity– Acceleration analysis of simple mechanisms – four bar chain – single slider crank chain - Coriolis component of acceleration

Gyroscope: Principle of gyroscope-gyroscopic couple- gyroscopic effect in an aero plane, ship- simple Problems.

Unit 3 Gears & Gear trains 09

Gears: Gear terminology-classification of toothed wheels -Involute and cycloidal gear profiles- law of gearing – interference in involute gears -Length of path of contact- arc of contact- contact ratio.

Gear Trains: Types of gear trains –epicyclic gear trains-simple problems.

Unit 4 Balancing of Rotating masses & Balancing of Reciprocating masses 10

Balancing of Rotating masses: Need for balancing, balancing of single mass and several masses indifferent planes, using analytical and graphical methods.

Balancing of Reciprocating masses: Primary and Secondary balancing of reciprocating masses – graphical Method – balancing of locomotives – variation of tractive force, swaying couple, hammer blow.

Unit 5 Vibrations **09**

Introduction-Types of vibratory motion-Types of free vibrations-Natural frequency of free longitudinal vibrations-equilibrium method and energy method –Transverse vibrations –Dunkerly's method-Whirling speed of shafts- simple systems (Cantilever and Simply supported beams).
Torsional vibrations - Natural frequency of torsional vibration- Single rotor, and Two-rotor system.

Prescribed Textbooks:

1. P.L. Ballaney, Theory of Machines & Mechanisms, 25/e, Khanna Publishers.
2. S.S. Rattan, Theory of Machines, 4/e, Tata McGraw Hill.

Reference Books:

1. J.E. Shigley, Theory of Machines and Mechanisms, 4/e, Oxford.
2. R.S.Khurmi &J.K.Gupta, Theory of Machines, S. Chand Publications.
3. Thomas Bevan, Theory of Machines, 3rd edition, CBS Publishers & Distributors, .
4. Jagadishlal, Theory of Mechanisms and Machines, Metropolitan Company Pvt Ltd.
5. R.K.Bansal, Theory of Machines, Lakshmi Publications.

Web Resources:

1. NPTEL :: Mechanical Engineering - Theory Of Mechanisms
2. Theory of Machine 02 | Simple Mechanism Part-2 - Question Practice Series | Abhyas | ME | GATE
3. Lecture 26: Analytical Velocity Analysis – III
4. Lecture 42 : Gears: Basic Concepts
5. Module 4 Lecture 1 Balancing of Single Slider Machines
6. NPTEL :: Mechanical Engineering - Mechanical Vibrations

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Modern tool usage	The Engineer and the World	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
24AMEC43T.1	3	3	2	2	-	-	1	-	1	-	1	1	2
24AMEC43T.2	3	3	2	2	-	-	1	-	1	-	1	3	2
24AMEC43T.3	3	3	2	2	-	-	1	-	1	-	1	2	1
24AMEC43T.4	3	3	2	2	-	-	1	-	1	-	1	2	3
24AMEC43T.5	3	3	2	2	-	-	1	-	1	-	1	1	2

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RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course: Thermal Energy Systems
Category: PC
Semester: IV Semester
Course Code: 24AMEC44T
Branch/es: Mechanical Engineering

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

1. To familiarize about the Rankine cycle used for steam power plant & steam boilers.
2. To impart knowledge on the working of nozzles and condensers used in steam power plants.
3. To impart knowledge on the working of steam turbines.
4. To understand the principle and operation of various Refrigeration methods.
5. To acquire knowledge on different Psychometric Processes & Air conditioning systems.

Course Outcomes:

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

1. Calculate the efficiency of Rankine cycle and summarize the working of different boilers used in steam power plant.
2. Analyze the flow through Nozzles and condensers used in steam power plant.
3. Solve the performance parameters of Steam Turbines.
4. Explain various refrigeration methods for specific uses.
5. Analyze various heat load concepts using RSHF and GSHF using psychrometric processes for different air conditioning systems.

Unit 1 Introduction to steam power plant 10

Rankine cycle - Schematic layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat addition, Methods to improve cycle performance – Regeneration – reheating.

Boilers: Classification based on Working principles - Fire tube and water tube boilers – High pressure Boilers.

Unit 2 Steam Nozzles & Condensers 10

Steam Nozzles: Function of nozzle – applications - types, Flow through nozzles, thermodynamic analysis – assumptions -velocity of nozzle at exit- Ideal and actual expansion in nozzle, velocity coefficient, condition for maximum discharge, critical pressure ratio.

Condensers: 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.

Unit 3 Steam Turbines 10

Classification of steam turbines -impulse turbine and reaction turbine -compounding of turbines - velocity diagrams for impulse and reaction turbines, efficiency, degree of reaction - governing of turbines.

Unit 4 Refrigeration 12

Introduction: Refrigeration, Necessity and applications – Unit of refrigeration and C.O.P. – Different refrigeration methods.

Air Refrigeration: Bell Coleman Cycle-Simple air-cooling system- Refrigeration needs of Air craft.

Vapour Compression Refrigeration: Basic cycle - working principle and essential components of the plant – COP – Expander vs. Throttling, effect of sub cooling and super heating – numerical Problems.
Vapour Absorption Refrigeration System: Description and working of NH_3- water system, Li Br –water (Two shell) System, Principle of operation of three Fluid absorption systems, properties of common refrigerants.

Unit 5 Air Conditioning 12

Psychometric Properties & Processes – 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 systems (elementary treatment).

Prescribed Textbooks:

1. Thermal Engineering, R.K. Rajput, S.Chand & Co., 10th edition 2020, Laxmi publications, ISBN-9788131808047
2. Refrigeration and Air Conditioning by C P Arora, 4th Edition 2021. ISBN-13 : 978-9390385843

Reference Books:

1. Thermodynamics: An Engineering Approach, Cengel .Y.A and Boles M.A, 5/e, McGraw-Hill, 9th Ed 2019, ISBN-13: 978-9339221652
2. A Textbook of Thermal Engineering by R. S Khurmi & JS Gupta, S.Chand, 16th Ed.2020, ISBN 9788121925730
3. A Course In Refrigeration And Air-Conditioning By Domkundwar, Arora, Domkundwar, 2022. ISBN-13 : 978-1111644475
4. A text book of Refrigeration and Air Conditioning by R.K Rajput , S K Kataria & sons, 3rd Edition 2015. ISBN-13 : 978-93-5014-255-4

Web resources:

1. https://archive.nptel.ac.in/courses/112/107/112107291/
2. https://youtu.be/DuLFDzQVTU4
3. https://youtu.be/h1Yt4ibYXfA
4. https://archive.nptel.ac.in/courses/112/107/112107216/
5. https://archive.nptel.ac.in/courses/112/105/112105128/

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Modern tool usage	The Engineer and the World	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
24AMEC44T.1	3	3	2	3	-	-	-	-	-	-	1	2	1
24AMEC44T.2	3	2	2	2	-	-	-	-	-	-	1	2	1
24AMEC44T.3	3	3	2	3	-	-	-	-	-	-	1	2	1
24AMEC44T.4	3	2	2	1	-	-	-	-	-	-	2	2	2
24AMEC44T.5	3	3	2	3	-	-	-	-	-	-	2	2	3

ANNAMACHARYA UNIVERSITY

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RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course: Fluid Mechanics and Hydraulic Machines Lab
Category: PC (LAB)
Semester: IV Semester
Course Code: 24AMEC42L
Branch/es: Mechanical Engineering

Lecture Hours	Tutorial Hours	Practice Hours	Credits
-	-	3	1.5

Course Objectives:

1. To provide knowledge in verifying Bernoulli's Theorem.
2. To impart knowledge in fluid flow measuring devices like Venturimeter & Orifice meter.
3. To understand frictional losses in pipes with various diameters.
4. To understand impact of jet on vanes like flat vane & semicircular vane.
5. To acquire knowledge about various hydraulic machines like centrifugal pump, reciprocating pump, Pelton wheel, Francis turbine, Kaplan turbine etc.

Course Outcomes:

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

1. Apply the Bernoulli's Theorem for different flow channels.
2. Calculate the flow rate of fluids by the instruments like Venturimeter and Orificemeter.
3. Calculate the frictional losses in pipes.
4. Evaluate impact of jet on vanes like Flat vane & Semi-circular vane.
5. Evaluate different performance parameters of hydraulic machines like pumps and turbines.

List of Experiments

1. Verification of Bernoulli's Theorem
2. Flow Through Venturimeter
3. Flow Through orifice meter
4. Determination of frictional losses in a given pile line.
5. Determination of loss of head due to sudden contraction in a pipeline.
6. Performance Test on Single Stage Centrifugal Pump
7. Performance Test on Multi Stage Centrifugal Pump.
8. Performance Test on Reciprocating Pump.
9. Impact of Jet on Vanes.
10. Performance Test on Pelton Wheel.
11. Performance Test on Francis Turbine.
12. Performance Test on Kaplan Turbine.
13. Turbine flow meter.

Note: Any 10 of the above 13 experiments are to be conducted.

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Modern tool usage	The Engineer and the World	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
24AMEC42L.1	3	2	2	2	-	-	-	1	-	-	-	2	1
24AMEC42L.2	3	2	2	2	-	-	-	1	-	-	-	2	1
24AMEC42L.3	3	2	2	2	-	-	-	1	-	-	-	2	1
24AMEC42L.4	3	3	2	3	-	-	-	1	-	-	1	2	2
24AMEC42L.5	3	3	2	3	-	-	1	1	-	-	1	2	2

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RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course: Theory of Machines Lab
Category: PC (LAB)
Semester: IV Semester
Course Code: 24AMEC43L
Branch/es: Mechanical Engineering

Lecture Hours	Tutorial Hours	Practice Hours	Credits
-	-	3	1.5

Course Objectives:

1. To understand the fundamentals of the theory of kinematics and dynamics of machines.
2. To understand techniques for studying motion of machines and their components.
3. To understand the vibrational behavior of systems, principles of gyroscope and governors.

Course Outcomes:

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

1. Analyze the different inversions of mechanisms.
2. Apply the principles of gyroscopic effects and stabilization on various transport vehicles.
3. Analyze the characteristics of governors.
4. Analyze the vibration parameters of different systems.
5. Analyze Tribological behaviour of materials.

List of Experiments:

1. To study inversion of four Bar Mechanism, single slider crank chain mechanism and Double slider crank chain mechanism.
2. To find experimentally the Gyroscopic couple on Motorized Gyroscope and compare with applied couple.
3. Determination of characteristic curves of Watt Governor.
4. To study various types of Cam and Follower arrangement.
5. To determine critical speed or whirling speed of a rotating shaft and to verify the value theoretically.
6. Forced vibrations of a spring-mass system.
7. Determination of Torsional natural frequency of two rotor system.
8. Determination of damped natural frequency of Torsional vibrating system.
9. To perform the experiment of Balancing of rotating parts and find the unbalanced couple and forces.
10. To determine the Tribological properties (wear rate and coefficient of friction) of materials.
11. Determination of characteristic curves of Proell Governor

Note: Any 10 experiments need to be performed

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Modern tool usage	The Engineer and the World	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
24AMEC43L.1	3	3	2	3	-	-	1	-	-	-	-	3	3
24AMEC43L.2	3	3	2	3	-	-	-	-	-	-	-	3	3
24AMEC43L.3	3	3	2	3	-	-	-	-	-	-	-	2	2
24AMEC43L.4	3	3	2	3	-	-	-	-	-	-	-	3	3
24AMEC43L.5	3	3	2	3	-	-	-	-	-	-	-	2	2

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(UNIVERSITY LISTED IN UGC AS PER THE SECTION 2(f) OF THE UGC ACT, 1956)

RAJAMPET, Annamayya District, AP – 516126, INDIA

Title of the Course: Python for Data Science
Category: SEC
Semester: IV Semester
Course Code: 24ACSE47L
Branch/es: Mechanical Engineering

Lecture Hours	Tutorial Hours	Practice Hours	Credits
1	-	2	2

Course Objectives:

1. To develop proficiency in Python programming and NumPy for numerical computing
2. To utilize Pandas for data analysis and Create insightful visualizations

Course Outcomes:

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

1. Write python programs using the core concepts like Lists, Dictionaries, sets, tuple, functions.
2. Demonstrate various mathematical operations on arrays using NumPy
3. Analyze and manipulate Data using Pandas
4. Create and customize fundamental 2D plots using Matplotlib
5. Plot customization 3D visualization.

Unit 1 Introduction to Python 09

Data Types: Strings, Numbers, Booleans, Date and Time, Lists, Tuples, Dictionaries, Operators, Conditional Statements, Loops, Functions.

Unit 2 Introduction to NumPy 07

The Basics of NumPy Arrays, Computation on NumPy Arrays: Universal Functions, Aggregations: Min, Max, and Everything in Between, Computation on Arrays: Broadcasting, Comparisons, Masks, and Boolean Logic, Fancy Indexing, Sorting Arrays.

Unit 3 Data Manipulation with Pandas 07

Introducing Pandas Objects, Data Indexing and Selection, Operating on Data in Pandas, Handling Missing Data, Hierarchical Indexing, Combining Datasets: Concat and Append, Combining Datasets: Merge and Join, Aggregation and Grouping Planets Data.

Unit 4 Visualization with Matplotlib 07

Two Interfaces for the Price of One, Simple Line Plots, Simple Scatter Plots, Visualizing Errors, Density and Contour Plots, Histograms, Binnings, and Density.

Unit 5 Advanced Customization and 3D Visualization 06

Customizing Plot Legends, Customizing Colorbars, Multiple Subplots, Text and Annotation, Customizing Ticks, Customizing Matplotlib: Configurations and Stylesheets, Three-Dimensional plotting in Matplotlib.

Prescribed Textbooks:

1. Python Data Science Handbook: Essential Tools for Working with Data, JakeVanderPlas, O'reilly publications, 2016.

Reference Books:

1. Python® for Programmers -Paul Deitel, Harvey Deitel, Pearson Education, Inc,2019
2. Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data- David Dietrich, Barry Heller, Beibei Yang, Published by John Wiley & Sons, Inc, 2015

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Modern tool usage	The Engineer and the World	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
24ACSE47L.1	3	3	2	3	1	-	-	-	-	-	-	2	2
24ACSE47L.2	3	3	2	3	2	-	-	-	-	-	-	1	2
24ACSE47L.3	3	3	2	3	2	-	-	-	-	-	-	2	2
24ACSE47L.4	3	3	2	3	2	-	-	-	-	-	-	2	2
24ACSE47L.5	3	3	2	3	2	-	-	-	-	-	-	1	2