GEETHANJALI INSTITUTE OF SCIENCE & TECHNOLOGY: NELLORE

(AUTONOMOUS)

NELLORE–524317 (A.P) INDIA

B.TECH IN MECHANICAL ENGINEERING

(ACCREDITATED BY NBA)

COURSE STRUCTURE AND SYLLABI UNDER RG 22 REGULATIONS

GEETHANJALI INSTITUTE OF SCIENCE AND TECHNOLOGY
(AUTONOMOUS)
NELLORE – 524137 (A.P) INDIA

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Mechanical Engineering
II B.TECH.

Semester-III (Theory–6, Lab–3, Skill Course-1, Mandatory Course-1)							
S.No.	Course Code	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	22A0015T	Complex Variables, & Numerical methods	BSC	2	1	0	3
2.	22A0305T	Manufacturing Processes	PCC	3	0	0	3
3.	22A0307T	Material Science & Engineering	PCC	3	0	0	3
4.	22A0309T	Engineering Mechanics	PCC	2	1	0	3
5.	22A0310T	Thermodynamics	PCC	2	1	0	3
6.	22A0022T	Managerial Economics and Financial Analysis	HSSC	3	0	0	3
7.	22A0306P	Manufacturing Processes Lab	PCC	0	0	3	1.5
8.	22A0308P	Material Science and Engineering Lab	PCC	0	0	3	1.5
9.	22A0311P	Solid Modeling Lab	PCC	0	0	3	1.5
10.	22A0539P	**Skill oriented course** Java programming	SOC	1	0	2	2
11	22A0028M	**Mandatory Course–I** Environmental Science	MC	2	0	0	0
						Total	**24.5**

Distribution of Credits among the Category of Courses		
S.No	Category of Courses Introduced	Credits Assigned
1	Basic Science Courses (1T)	3
2	Professional Core Courses (4T+1L)	16.5
3	Humanities and Social Science Courses (1T)	3
4	Skill Oriented Course - 1 (T+P)	2
5	Mandatory Non Credit Course (1T)	0
Total Credits		24.5

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Complex Variables, & Numerical methods					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0015T	**2: 1:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**BSC**

Course Objectives:

- This course aims at providing the student to acquire the knowledge on the calculus of functions of complex variables. The aim is to analyze the solutions of partial differential equations.

Syllabus		**Total Hours:44**
Unit-I	**Complex Variable – Differentiation:**	**9Hrs**

Introduction to functions of complex variable-concept of Limit & continuity-Differentiation, Cauchy-Riemann equations, analytic functions (exponential, trigonometric, logarithm), harmonic functions, finding harmonic conjugate-construction of analytic function by Milne Thomson method- Conformal mappings-standard transformations (ez, , kz) Mobius transformations (bilinear) and their properties.

Unit-II	**Complex Variable – Integration:**	**9Hrs**

Line integral-Contour integration, Cauchy's integral theorem, Cauchy Integral formula, Liouville's theorem (without proof) and Maximum-Modulus theorem (without proof);power series expansions: Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals (around unit circle, semi circle with f(z) not having poles on real axis).

Unit-III	**Laplace Transforms**	**9Hrs**

Definition-Laplace transform of standard functions-existence of Laplace Transform – Inverse transform – First shifting Theorem, Transforms of derivatives and integrals – Unit step function – Second shifting theorem – Dirac's delta function – Convolution theorem – Laplace transform of Periodic function. Differentiation and integration of transform – solving Initial value problems to ordinary differential equations with constant coefficients using Laplace transforms.

Unit-IV	**Fourier series**	**8Hrs**

Determination of Fourier coefficients (Euler's) – Dirichlet conditions for the existence of Fourier series – functions having discontinuity-Fourier series of Even and odd functions– Fourier series in an arbitrary interval – Half-range Fourier sine and cosine expansions- typical wave forms -Parseval's formula- Complex form of Fourier series.

Unit-V	**Partial Differential Equations & Applications**	**9Hrs**

Solution of second order PDEs by Method of separation of variables – Solutions of one dimensional wave equation, one dimensional heat equation under initial and boundary conditions. Steady statetwo dimensional heat equations (Laplace equations).

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the analyticity of complex functions and conformal mappings.
- Apply cauchy's integral formula and cauchy's integral theorem to evaluate improper integrals along contours.
- Understand the usage of laplace transforms.
- Evaluate the fourier series expansion of periodic functions.
  Formulate/solve/classify the solutions of partial differential equations and also find the solution of one-dimensional wave equation and heat equation.

Textbooks:

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers. 42nd edition 29 September 2017.
2. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India, 10th edition 16 August 2011.

Reference Books:

1. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers, 1 July 2017.
2. Advanced Engineering Mathematics, by Alan Jeffrey, Elsevier, 1st Edition, June 13, 2001.

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Manufacturing Processes					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0305T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**PCC**

Course Objectives:

- To introduce the students to working principle of different metal casting processes and gating system.
- To impart knowledge on plastic deformation, cold and hot working process, working of a rolling mill and types, extrusion processes.
- To teach principles of forging, tools and dies, working of forging processes.
- To develop fundamental understanding on classification of the welding processes, working of different types of welding processes and welding defects.
- To impart knowledge on manufacturing methods of plastics, ceramics and powder metallurgy.
- To introduce the basic concepts of Unconventional Machining Processes.

Syllabus		**Total Hours:42**
UNIT - I	**Casting Processes**	**8 Hrs**

Introduction: Importance and selection of manufacturing processes.

Introduction to casting process, process steps; pattern and design of gating system; Solidification of casting: Concept, solidification of pure metal and alloy; Special casting processes: Shell casting, investment casting, die casting, centrifugal casting, casting defects and remedies.

UNIT - II	**Metal Forming & Forging**	**8 Hrs**

Introduction, nature of plastic deformation, hot and cold working of metals, mechanics of metal forming; Rolling: Principle, types of rolling mill and products, roll passes, forces in rolling and power requirements; Extrusion: Basic extrusion process and its characteristics, hot extrusion and cold extrusion, wire drawing, tube drawing.

Principles of forging, tools and dies. Types: Smith forging, drop forging, forging hammers, rotary forging and forging defects. Sheet metal forming: Mechanics of sheet metal working, blanking, piercing, bending, stamping.

UNIT - III	**Metal Joining Processes**	**8 Hrs**

Classification of welding processes, types of welds and welded joints and V-I characteristics, arc welding, weld bead geometry, submerged arc welding, gas tungsten arc welding, gas metal arc welding. applications, advantages and disadvantages of the above processes, Plasma Arc welding, Laser Beam Welding, Electron Beam Welding and Friction Stir Welding. Heat affected zones in welding; soldering and brazing: Types and their applications, Welding defects: causes and remedies.

UNIT - IV	Plastic Processing, Ceramics and Powder Metallurgy	8 Hrs

Plastics: Types, properties and their applications, processing of plastics, extrusion of plastics, transfer molding and compression molding, injection molding, thermoforming, rotational molding, and blow molding

Ceramics: Classification of ceramic materials, properties and their application, ceramic powder preparation; Processing of ceramic parts: Pressing, casting, sintering; Secondary processing of ceramics: Coatings, finishing.

Powder Metallurgy: Principle, manufacture of powders, steps involved.

UNIT - V	Unconventional Machining Processes	10 Hrs

principle and processes parameters of Electrical discharge machining (EDM), electro-chemical machining (ECM), Laser beam machining (LBM), plasma arc machining (PAM), electron beam machining, Abrasive jet machining (AJM), water jet machining (WJM), and ultrasonic machining(UM)

Course Outcomes (CO):

On completion of this course, student will be able to

- Demonstrate different metal casting processes and gating systems. (L2)
- Classify working of various welding processes. (L2)
- Evaluate the forces and power requirements in rolling process. (L5)
- Apply the principles of various forging operations. (L3)
- Outline the manufacturing methods of plastics, ceramics and powder metallurgy. (L1)
- Identify different unconventional processes and their applications. (L3)

Textbooks:

1. Rao P.N., Manufacturing Technology – Volume I, 5/e, McGraw-Hill Education, 2018.
2. Kalpakjain S and Schmid S.R., Manufacturing Engineering and Technology, 7/e, Pearson, 2018.

Reference Books:

1. Sidney H.Avner , Introduction to Physical Metallurgy, McGraw Hill Education,2 /e, 2017.
2. Millek P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes and Systems, 4/e, John Wiley and Sons Inc, 2010.
3. Sharma P.C., A Text book of Production Technology, S Chand Publishing,8/e, 2014.

Web links:

1. https://www.digimat.in/nptel/courses/video/112107145/L01.html
2. https://www.digimat.in/nptel/courses/video/112105126/L01.html

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Material Science & Engineering					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0307T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**PCC**

Course Objectives:

- To teach the principles of physical metallurgy, i.e. crystallography of metals, constitution of alloys, phase diagrams.
- Expose commercially important metals and alloys (both ferrous and non ferrous) with engineering constraints.
- Explain the methods to change the properties of materials through heat treatment processes.
- Familiarize properties and applications of ceramics, polymers and composite materials.
- Demonstrate the fundamental properties of nano-materials and their applications.

Syllabus		**Total Hours:42**
UNIT - I	**Metals & Alloys**	**8 Hrs**

Structure of Metals: Crystal Structures: Unit cells, Metallic crystal structures, Imperfection in solids: Point, Line, interstitial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress.

Constitution of Alloys: Necessity of Alloying, substitutional and interstitial solid solutions-Phase diagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron-Iron-carbide diagram and micro structural aspects of ferrite, cementite, austenite, ledeburite, and cast iron.

UNIT - II	**Metal Forming & Forging**	**8 Hrs**

Steels:
Plain carbon steels, use and limitations of plain carbon steels. AISI& BIS classification of steels. Classification of alloys steels. Microstructure, properties and applications of alloy steels-stainless steels and tool steels.
Cast irons:

Microstructure, properties and applications of white cast iron, malleable cast iron, grey cast iron, nodular cast iron and alloy cast irons.

UNIT - III	**Heat Treatment of Steels**	**8 Hrs**

Heat Treatment of Steels: Annealing, tempering, normalizing and hardening, isothermal transformation diagrams for Fe-Fe3C alloys and microstructure development. Continuous cooling curves and interpretation of final microstructures and properties- austempering, martempering, case hardening - carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, and vacuum and plasma hardening

UNIT - IV	Non-ferrous Metals and Alloys	8 Hrs
Non-ferrous Metals and Alloys: Microstructure, properties and applications of copper, aluminium, titanium, nickel and their alloys. Study of Al-Cu phase diagram		
UNIT - V	**Ceramics, Polymers and Composites**	**10 Hrs**
Ceramics, Polymers and Composites: Structure, properties and applications of ceramics, polymers and composites. Introduction to super alloys and nanomaterials.		

Course Outcomes (CO):

On completion of this course, student will be able to

- Explain the principles of binary phases. (l2)
- Select steels and cast irons for a given application. (l3)
- Apply heat treatment to different applications. (l3)
- Utilize nonferrous metals and alloys in engineering. (l3)
- Choose composites for various applications. (l3)
- Assess the properties of nano-scale materials and their applications. (l2)
- Differentiate between hardening of ferrous and non-ferrous alloys. (L4)

Textbooks:

1. V.Raghavan, Material Science and Engineering, 5/e, Prentice Hall of India, 2004.
2. R.Balasubramaniam, Callister's Material Science and Engineering, 2/e, Wiley India, 2014.

Reference Books:

1. Y. Lakhtin, Engineering Physical Metallurgy, University Press of the Pacific, 2000.
2. S.H.Avner, Introduction to Physical Metallurgy, 2/e, Tata McGraw- Hill, 1997.
3. L.H.Van Vlack, Elements of Material Science and Engineering, 6/e, Pearson Education, 2008.
4. George E.Dieter, Mechanical Metallurgy, 3/e, McGraw-Hill, 2013.

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Engineering Mechanics					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0309T	**2: 1:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**PCC**

Course Objectives:

- Explain the effect of force and moment in different engineering applications.
- Find the centre of gravity and moment of inertia of solids and surfaces.
- Familiarize frictional forces in mechanical applications.
- Analysis of rigid bodies under dynamic conditions.

Syllabus		**Total Hours:49**
Module-I	**Introduction to types of forces and Friction**	**12Hrs**

Introduction to Engineering Mechanics: Composition and resolution of forces, parallelogram law, principle of transmissibility, types of force systems - concurrent and concurrent coplanar forces, resultant of coplanar force systems couple, moment of a force Varignon's theorem, concept of free body diagrams, concept of equilibrium of coplanar force systems.

Friction: Laws of friction, types of friction, equilibrium of force systems involving frictional forces, wedge friction. Free body diagrams involving frictional forces.

Module-II	**Analysis of Structures and Virtual Work**	**10Hrs**

Analysis of Structures: Introduction to plane trusses, analysis of plane trusses by method of joints and method of sections.

Virtual Work: Equilibrium of ideal systems, work done by a force, work done by a couple, principle of virtual work.

Module-III	**Properties of Surfaces and Volumes and Moment of Inertia**	**9Hrs**

Properties of Surfaces and Volumes: Centroid and center of gravity, derivation of centroids from first moment of area, centroids of composite sections, center of gravity of common volumes - cylinder, cone, sphere, theorem of Pappus-guidinus.

Moment of Inertia: Area moment of inertia of plane and composite shapes, parallel axis theorem, perpendicular axis theorem, polar moment of inertia, mass moment of inertia of common volumes -thin plates, thin rod, cylinder, cone, sphere, rectangular prism, radius of gyration.

Module-IV	**Kinematics**	**9Hrs**

Kinematics: Equations of motion for rigid bodies, constant and variable acceleration, rectilinear and curvilinear motion, motion under gravity -projectile motion, use of rectangular coordinates, tangential and normal coordinates, radius of curvature, rotation of a rigid body about a fixed axis, introduction to plane motion.

Module-V	Kinetics	9Hrs

Kinetics: Principles of dynamics - Newton's Laws of motion, D'Alembert's principle in rectilinear translation, principle of work and energy.

Ideal Systems: Principle of conservation of energy, concept of power, conservation of linear and angular momentum, principle of momentum and impulse, impact - types of impact.

Course Outcomes (CO):

On completion of this course, student will be able to

- Resolve forces and couples in mechanical systems.(L3)
- Identify the frictional forces and its influence on equilibrium.(L3)
- Find the centre of gravity and moment of inertia for various geometric shapes(L3)
- Develop equations for different motions.(L4)
- Determine the displacement, velocity and acceleration relations in dynamic systems(L4)
- Relate the impulse and momentum (L4)

Textbooks:

1. S S Bhavikatti, “Engineering Mechanics”, 4th edition, New Age International, 2008.
2. S Timoshenko, DH Young, JV Rao, Sukumar Pati, “Engineering Mechanics (in SI units)”, 5th edition, McGraw Hill, 2013.

Reference Books:

1. Basudeb Bhattacharya., “Engineering Mechanics”, 2nd edition, Oxford University Press (India), 2015.
2. Irving Shames, G K M Rao, “Engineering Mechanics: Statics and Dynam-ics”, 4th edition, Pearson, 2009.
3. K L Kumar, Veenu Kumar, “Engineering Mechanics”, 4th edition, Tata McGraw Hill, 2010.

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Thermodynamics					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0310T	**2: 1:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**PCC**

Course Objectives:

- To introduce the concepts of heat, work, energy and governing rules for conversion of one form to other.
- To explain relationships between properties of matter and basic laws of thermodynamics.
- To teach the concept of entropy for identifying the disorder and feasibility of a thermodynamic process.
- To introduce the concept of available energy for maximum work conversion.
- To impart knowledge on steam properties.
- To provide fundamental concepts of air standard cycles used in IC engines and gas turbines.

Syllabus		**Total Hours:42**
UNIT - I	**First law of Thermodynamics**	**10 Hrs**

Introduction: Basic Concepts: Macroscopic and microscopic viewpoints, definitions of thermodynamic terms, quasi – static process, point and path function, forms of energy, ideal gas and real gas, Zeroth law of thermodynamics and Temperature measurement.

Joule's experiment - first law of thermodynamics, corollaries-perpetual motion machines of first kind, first law applied to non-flow and flow process- limitations of first law of thermodynamics**.**

UNIT - II	**Second Law of Thermodynamics**	**8 Hrs**

Kelvin - Planck statement and Clausius statement and their equivalence, corollaries - perpetual motion machines of second kind - reversibility and irreversibility, cause of irreversibility - Carnot cycle, heat engine, heat pump and refrigerator, Carnot theorem, Carnot efficiency.

UNIT - III	**Entropy, Availability and Irreversibility**	**8 Hrs**

Clausius inequality - Concept of Entropy- entropy equation for different processes and systems. Definition of exergy and anergy, expressions for availability and irreversibility. Availability in steadyflow, non-flow processes and irreversibility.

Maxwell relations, TdS equations difference in heat capacities, ratio of heat capacities.

UNIT - IV	**Properties of Steam and use of Steam Tables**	**8 Hrs**

Pure Substances, P-V-T surfaces, T-s and h-s diagram, Mollier chart, dryness fraction, property tables, analysis of steam undergoing various thermodynamic processes using Mollier chart– steam calorimetry. Energy equation, Joule Thompson coefficient Clausius - Clapeyron equation.

UNIT - V	Air Standard Cycles	8 Hrs

Otto, Diesel and dual cycles, P-V and T -S diagrams - description and efficiencies, mean effective pressures. Brayton Cycle - Comparison of Otto, Diesel and dual cycles, Comparison of Brayton and Otto Cycles.

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the importance of thermodynamic properties related to conversion of heat energy into work. (L1)
- Apply the laws of thermodynamics to boilers, heat pumps, refrigerators, heat engines, compressors and nozzles. (L3)
- Utilize steam properties to design steam based components. (L4)
- Analyze thermodynamic relations and air standard cycles. (L5)

Textbooks:

1. P.K.Nag, Engineering Thermodynamics, 5/e, Tata McGraw Hill, 2013.
2. Yunus A. Cengel, Michaela A. Boles, Thermodynamics, 7/e, Tata McGraw Hill, 2011.

Reference Books:

1. J.B.Jones and G.A.Hawkins, Introduction to Thermodynamics, 2/e, John Wiley & Sons, 2012.
2. Moran, Michael J. and Howard N. Shapiro, Fundamentals of Engineering Thermodynamics, 3/e, Wiley, 2015
3. R.K. Rajput, S.Chand& Co., Thermal Engineering, 6/e, Laxmi publications, 2010

Web links:

1. https://nptel.ac.in/courses/112/105/112105266/
2. https://nptel.ac.in/courses/112/104/112104113/

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Managerial Economics and Financial Analysis					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0022T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**HSSC**

Course Objectives:

- To understand the concepts of managerial economics and financial analysis this helps in optimal decision making in business environment.
- To have a thorough knowledge on the production theories and cost while dealing with the production and factors of production.
- To have a thorough knowledge regarding market structure and forms of business organizations in the market.
- To understand the concept of capital and capital budgeting in selecting the proposals.
- To have a thorough knowledge on recording, classifying and summarizing of transactions in preparing of final accounts.

Syllabus		**Total Hours:48**
Module-I	**Introduction To Managerial Economics &Demand**	**9 Hrs**

Managerial Economics – Definition – Nature & Scope - Contemporary importance of Managerial Economics - Demand Analysis - Concept of Demand - Demand Function - Law of Demand - Elasticity of Demand - Significance - Types of Elasticity - Measurement of Elasticity of Demand - Demand Forecasting - Factors governing Demand Forecasting - Methods of Demand Forecasting - Relationship of Managerial Economics with Financial Accounting and Management.

Module-II	**Theory Of Production And Cost Analysis**	**9 Hrs**

Production Function – Least-cost combination - Short-run and Long-run Production Function - Isoquants and Isocosts, MRTS - Cobb-Douglas Production Function - Laws of Returns - Internal and External Economies of scale - Cost concepts and Cost behavior - Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems) - Managerial significance and limitations of Break-Even Analysis.

Module-III	**Introduction to Markets And forms Of Business Organiztions**	**10 Hrs**

Market structures - Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition – Monopoly - Monopolistic Competition – Oligopoly - Price-Output Determination - Pricing Methods and Strategies - Forms of Business Organizations - Sole Proprietorship - Partnership - Joint Stock Companies - Public Sector Enterprises-.

Module-IV	**Capital And Capital Budgeting**	**10 Hrs**

Concept of Capital - Significance - Types of Capital - Components of Working Capital Sources of Short-term and Long-term Capital - Estimating Working capital requirements – Capital Budgeting – Features of Capital Budgeting Proposals – Methods and Evaluation of Capital Budgeting Projects – Pay Back Method – Accounting Rate of Return (ARR) – Net Present Value (NPV) – Internal Rate Return (IRR) Method (simple problems)

Module-V	Introduction to Financial Accounting and Analysis	10 Hrs

Accounting Concepts and Conventions - Introduction Double-Entry Book Keeping, Journal, Ledger, and Trial Balance - Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments).Financial Analysis - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

Course Outcomes (CO):

On completion of this course, student will be able to

- Outline the Managerial Economic concepts for decision making and forward planning. Also know law of demand and its exceptions, to use different forecasting methods for predicting demand for various products and services. (L2)
- Assess the functional relationship between Production and factors of production and list out various costs associated with production and able to compute breakeven point to illustrate the various uses of breakeven analysis. (L5)
- Outline the different types of business organizations and provide a framework for analyzing money in its functions as a medium of exchange. (L2)
- Interpret various techniques for assessing the proposals of project for financial position of the business. (L2)
- Identify the principles of accounting to record, classify and summarize various transactions in books of accounts for preparation of final accounts. (L3)

Textbooks:

1. Managerial Economics, PL Mehata, Sulthan Chand Publications, 21e, 2016

Reference Books:

1. Ahuja Hl “Managerial economics” 3 rd edition, Schand, ,2013
2. S.A. Siddiqui and A.S. Siddiqui: “Managerial Economics and Financial Analysis”, New Age International,. 2013.
3. Joseph G. Nellis and David Parker: “Principles of Business Economics”, 2nd edition, Pearson, New Delhi,2/e,2007
4. Domnick Salvatore: “Managerial Economics in a Global Economy”, Cengage, 2013.
5. Managerial Economics, Varshney &Maheswari, Sultan Chand, 2013.
6. Managerial Economics and Financial Analysis, Aryasri, 4th edition, MGH, 2019

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Manufacturing Processes Lab					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0306P	**0: 0:3:0**	**1.5**	**CIE: 30 SEE:70**	**3Hours**	**PCC**

Course Objectives:

- Acquire practical knowledge on Metal Casting, Welding, Press Working and unconventional machining Processes

Syllabus **Total Hours:45**

1. **METAL CASTING**
   a) Gating Design and pouring time and solidification time calculations.
   b) Sand Properties Testing – Exercise for Strength and Permeability.
   C) Molding, Melting and Casting for ferrous/ non ferrous materials.
2. **WELDING**
   a) TIG Welding.
   b) MIG Welding.
   c) Friction stir welding.
   d) Any other Special Welding Processes.
3. **MECHANICAL PRESS WORKING**
   a) Press Tool: Blanking and Piercing operation with Simple, Compound and Combination dies.
   b) Closed die forging, Deep Drawing and Extrusion operations.
4. **UN CONVENTIONAL MANUFACTUNRING PROCESSES**
   a) Electro Discharge Machining (EDM) / Wire cut EDM
   b) Plasma arc cutting / Abrasive jet machining (AJM)

Additive manufacturing with reverse engineering

Course Outcomes(CO):

On completion of this course, student will be able to

- Fabricate different types of components using various manufacturing techniques. (L6)
- Adapt unconventional manufacturing methods. (L6)

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Material Science and Engineering Lab					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0308P	**0: 0:3:0**	**1.5**	**CIE: 30 SEE:70**	**3Hours**	**PCC**

Course Objectives:

- To understand the microstructure and hardness of engineering materials.
- To explain grain boundaries and grain sizes of different engineering materials.

Syllabus **Total Hours:45**

1. Metallography sample preparation
2. Microstructure of pure metals – Iron, copper and aluminum as per ASTM standards
3. Microstructure of low carbon steel, mild steel and high carbon microstructure of cast irons.
4. Microstructure of non-ferrous alloys – aluminum, copper, titanium, nickel and their alloys.
5. Hardenability of steels by Jominy End Quench Test.
6. Microstructure of heat treated steels.
7. Hardness of various untreated and treated steels.
8. Microstructure of ceramics, polymeric materials.
9. Microstructure of super alloy and nano-materials.
10. Hardness of ceramics, super alloys, nano-materials and polymeric materials (one sample on each)

Course Outcomes (CO):

On completion of this course, student will be able to

- Differentiate various microstructures of ferrous and non-ferrous metals and alloys. (l4)
- Visualize grains and grain boundaries. (l3)
- Importance of hardening of steels. (l2)
- Evaluate hardness of treated and untreated steels. (l4)
- Differentiate hardness of super alloys, ceramics and polymeric materials(l2)

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Solid Modeling Lab					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0308P	**0: 0:3:0**	**1.5**	**CIE: 30 SEE:70**	**3Hours**	**PCC**

Course Objectives:

- To impart hands on training for drafting , modeling and assembly of machine parts using modeling package.

Syllabus — **Total Hours:45**

1. Drafting of cotter joint
2. Drafting of coupling
3. Drafting of bearing
4. Drafting of riveted joint
5. Modeling and assembly of stuffing box parts.
6. Modeling and assembly of steam engine cross head parts.
7. Modeling and assembly of lathe single way tool post parts.
8. Modeling and assembly of knuckle joint parts.
9. Modeling and assembly of plummer block parts
10. Modeling and assembly of screw jack parts
11. Modeling and assembly of IC engine piston parts
12. Modeling of parts of Eccentric and generation of orthographic views.

Course Outcomes (CO):

On completion of this course, student will be able to

- Draft Different Views Of Machine Elements And Parts
- Model Individual Parts And Assemble Them.

GEETHANJALI INSTITUTE OF SCIENCE AND TECHNOLOGY
(AUTONOMOUS)
NELLORE – 524137 (A.P) INDIA
Mechanical Engineering

Java Programming
(Common to EEE,ME and ECE)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0539	1: 0:2:0	2	CIE: 30 SEE:70	3Hours	SC

Course Objectives:

This course will enable students to:

- To introduce the fundamental concepts of object-oriented programming to design & implement object oriented programming concepts in Java.
- To obtain knowledge about the principles of inheritance and polymorphism
- Learn the usage of Control structures in java
- To implement the concept of Array, interfaces, exception handling
- To understand the usage of Threads in java

Syllabus | **Total Hours:48**

Module : 1

Fundamentals of Object Oriented Programming: Introduction, Object Oriented Paradigm, Basic concepts of OOP : Class, Object, Inheritance, Polymorphism, Abstraction, Encapsulation..

Task: introduction to Object Oriented Programming and its basic concepts.

Module : 2

Overview of Java Language: Introduction, Java features, Java program structure, parts of Java, Java Virtual Machine-Java versus C++, How to Compile & Executing a basic java program.

Task: Differences between Java and C++, Execute “Hello welcome to java” program

Module : 3

Variables-Identifiers-Literals- Data types: Integer literals-character literals-Floating point literals- String Literals, Variables, Keywords, Data types.

Task: implementing data types with variables, find valid/invalid variables, Identifiers

Module : 4

Operators: Arithmetic operators, Relational operators, Assignment operators, Conditional operators, Type casting/Type Conversion in java.

Task: Perform all arithmetic operators using a single program, program using typecast/type conversion

Module : 5

Java Statements: Input and Output Statements, Accepting Input from the Keyboard, Displaying output with System.out.printf( ) , Displaying Formatted output with

String.format( )
Task: Write a program using I/O statements in java.

Module : 6
Control Structures: Conditional control statements :- if ..statement, if… else statement-if-else-if ladder, Switch statement
Task: Write a program to find a person is eligible for vote >18?, Largest number among 3 numbers?

Module : 7
Looping/Repetitive/Iterative statements: While statement- Do ..While statement-For Statement, Continue statement-Break statement.
Task: print N natural numbers, sum of N natural numbers, Armstrong number, Strong number using for statement.

Module:8
Arrays: Arrays, One-dimensional arrays, Creating an array, Find The Length Of An Array, Types of Arrays:-Two-dimensional arrays, Creating a two-dimensional array.
Task: Find the N^{th} Largest value in an array, Insert and Addition of values using array

Module : 9
Strings: Introduction to strings, Built in strings, Creating Strings, String reverse, String Concatenation, String comparison, Immutability of Strings
Task: write a program to Perform all string operations as single output

Module : 10
Classes , Objects& Methods: Introduction, Defining a class, Adding Variables, Object Creation, Initializing the Instance variables, Access Specifiers, Methods, Constructors, Method Overloading
Task: To implement Class and Object concept, Method Overloading program

Module :11
Interfaces: Interface, Multiple Inheritance using Interfaces.
Exception Handling: Errors in Java Program, Exceptions, throws clause, throw clause, Types of Exceptions,
Task: Implement a program using exception handling, write a program Multiple Inheritance using Interfaces.

Module : 12
Threads: Introduction, Creating Threads, Extending the Threads, Stopping and Blocking a Thread, Life Cycle of a Thread. single Tasking Using a Thread, Multi tasking Using Threads
Task: Implement a program using Threads.

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the basic concepts of OOP
- Compare & Contrast basic constructs of C++ & Java
- Develop a program on operators in Java
- Apply Control statements to solve real time problems
- Analyze the concepts of constructers, overloading, Inheritance and Interfaces in java
- Implementing different types of Threads to solve real time problems

Reference Books:

1. Programming with Java by E.Balagurusamy.
2. Programming in Java by Sachin Malhotra, OXFORD University Press.
3. Java Complete Reference by Herbert Schildt.
4. John R.Hubbard, Programming with Java, Second Edition, Schaum's outline series, TATA McGraw-Hill Company.

Web Reference:

1. https://www.javatpoint.com/java-tutorial
2. https://www.learnjavaonline.org/
3. https://www.tutorialspoint.com/java/index.htm
4. https://www.w3schools.com/java/
5. https://www.geeksforgeeks.org/java/

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Environmental Science
Mandatory Course–I

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0027M	2: 0:0:0	0	CIE: 30 SEE:70	3Hours	MC

Course Objectives:

- To make the students to get awareness on environment
- To understand the importance of protecting natural resources, ecosystems for future generationsand pollution causes due to the day to day activities of human life
- To save earth from the inventions by the engineers.

Syllabus	Total Hours:46
UNIT - I	8 Hrs

Multidisciplinary Nature Of Environmental Studies: – Definition, Scope and Importance – Need for Public Awareness.

Natural Resources : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

UNIT - II	12 Hrs

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity And Its Conservation : Introduction 0 Definition: genetic, species and ecosystem diversity

– Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT - III		8 Hrs

Environmental Pollution: Definition, Cause, effects and control measures of :

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

Solid Waste Management: Causes**,** effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

UNIT - IV		10 Hrs

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT - V		8 Hrs

Human Population And The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc..

Course Outcomes (CO):

On completion of this course, student will be able to

- Grasp multidisciplinary nature of environmental studies and various renewable and nonrenewable resources.
- Understand flow and bio-geo- chemical cycles and ecological pyramids.
- Understand various causes of pollution and solid waste management and related preventive measures.
- About the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.

Casus of population explosion, value education and welfare programmes.

Textbooks:

1. Text book of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press.
2. Palaniswamy, “Environmental Studies”, Pearson education
3. S.Azeem Unnisa, “Environmental Studies” Academic Publishing Company
4. K.Raghavan Nambiar, “Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, Scitech Publications (India), Pvt. Ltd.

Reference Books:

1. Deeksha Dave and E.Sai Baba Reddy, “Textbook of Environmental Science”, Cengage Publications.
2. M.Anji Reddy, “Text book of Environmental Sciences and Technology”, BS Publication.
3. J.P.Sharma, Comprehensive Environmental studies, Laxmi publications.
4. J. Glynn Henry and Gary W. Heinke, “Environmental Sciences and Engineering”, Prentice hall of India Private limited
5. G.R.Chatwal, “A Text Book of Environmental Studies” Himalaya Publishing House
6. Gilbert M. Masters and Wendell P. Ela, “Introduction to Environmental Engineering and Science, Prentice hall of India Private limited.