JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.TECH. MECHANICAL ENGINEERING (NANO TECHNOLOGY)

COURSE STRUCTURE & SYLLABUS (2016-17)

II YEAR I SEMESTER

S. No	Course Code	Course Title	L	T	P	Credits
1	MA301BS	Mathematics - IV	4	1	0	4
2	ME305ES	Metallurgy and material science	4	1	0	4
3	ME302ES	Kinematics of machines	4	1	0	4
4	ME303ES	Mechanics of solids	3	0	0	3
5	ME304ES	Thermodynamics	3	0	0	3
6	ME308ES	Metallurgy and material science Lab	0	0	3	2
7	ME307ES	Mechanics of solids Lab	0	0	3	2
8	EE308ES	Electrical and Electronics Engineering Lab	0	0	3	2
9	*MC300HS	Gender Sensitization lab	0	0	3	0
		Total Credits	**18**	**3**	**12**	**24**

II YEAR II SEMESTER

S. No	Course Code	Course Title	L	T	P	Credits
1	NT401ES	Production Technology	4	1	0	4
2	NT402ES	Design of Machine Members-I	4	1	0	4
3	ME401ES	Fluid Mechanics and Hydraulic Machines	4	1	0	4
4	NT403ES	Dynamics of Machines	3	0	0	3
5	SM405MS	Business Economics and Financial Analysis	3	0	0	3
6	NT406ES	Production Technology Lab	0	0	3	2
7	ME407ES	Fluid Mechanics and Hydraulic Machines Lab	0	0	3	2
8	NT408ES	Dynamics of Machines Lab	0	0	3	2
9	*MC400ES	Environmental Science and Technology	3	0	0	0
		Total Credits	**21**	**3**	**9**	**24**

MA301BS: MATHEMATICS – IV
(Complex Variables and Fourier Analysis)

B.Tech. II Year I Sem.	**L**	**T/P/D**	**C**
	4	**1/0/0**	**4**

Prerequisites: Foundation course (No Prerequisites)**.**

Course Objectives: To learn

- differentiation and integration of complex valued functions
- evaluation of integrals using Cauchy's integral formula
- Laurent's series expansion of complex functions
- evaluation of integrals using Residue theorem
- express a periodic function by Fourier series and a non periodic function by Fourier transform
- to analyze the displacements of one dimensional wave and distribution of one dimensional heat equation

Course Outcomes: After learning the contents of this paper the student must be able to

- analyze the complex functions with reference to their analyticity, integration using Cauchy's integral theorem
- find the Taylor's and Laurent's series expansion of complex functions
- the bilinear transformation
- express any periodic function in term of sines and cosines
- express a non-periodic function as integral representation
- analyze one dimensional wave and heat equation

UNIT – I

Functions of a complex variable: Introduction, Continuity, Differentiability, Analyticity, properties, Cauchy, Riemann equations in Cartesian and polar coordinates**.** Harmonic and conjugate harmonic functions-Milne-Thompson method

UNIT - II

Complex integration: Line integral, Cauchy's integral theorem, Cauchy's integral formula, Generalized Cauchy's integral formula, Power series: Taylor's series- Laurent series, Singular points, Isolated singular points, pole of order m – essential singularity, Residue, Cauchy Residue theorem (Without proof).

UNIT – III

Evaluation of Integrals: Types of real integrals:

(a) Improper real integrals $\int_{-\infty}^{\infty} f(x)dx$

(b) $\int_{c}^{c+2\pi} f(\cos\theta, \sin\theta)d\theta$

Bilinear transformation- fixed point- cross ratio- properties- invariance of circles.

UNIT – IV

Fourier Series and Transforms: Introduction, Periodic functions, Fourier series of periodic function, Dirichlet's conditions, Even and odd functions, Change of interval, Half range sine and cosine series.

Fourier integral theorem (without proof), Fourier sine and cosine integrals, sine and cosine, transforms, properties, inverse transforms, Finite Fourier transforms.

UNIT – V

Applications of PDE: Classification of second order partial differential equations, method of separation of variables, Solution of one dimensional wave and heat equations.

TEXT BOOKS:

1. A first course in complex analysis with applications by Dennis G. Zill and Patrick Shanahan, Johns and Bartlett Publishers.
2. Higher Engineering Mathematics by Dr. B. S. Grewal, Khanna Publishers.

REFERENCES:

1. Fundamentals of Complex Analysis by Saff, E. B. and A. D. Snider, Pearson.
2. Advanced Engineering Mathematics by Louis C. Barrett, McGraw Hill.

ME305ES: METALLURGY AND MATERIALS SCIENCE

B.Tech. II Year I Sem.

L	T	P	C
4	1	0	4

Course Overview: The subject deals with the materials and their properties, commonly used for the manufacturing various components in industry. The quantificational procedures of property estimations and the study of various phase diagrams of alloy materials .The ferrous materials and Non Ferrous materials, their properties and applications in the industries are incorporated. The importance of composite materials and ceramics are included.

The course is designed for the Second year first semester students. The course will provide an over view of the study of basic knowledge of various materials and their properties, applications.

The Study of basic alloy systems formation and their phase diagrams. The strengthening mechanisms of various alloys.

At the end of the course, the student is expected to possess knowledge in various materials and their properties.

Selection of materials based on their applications. Developing new materials and their testing methods of property evaluation. Pre- requisites: Thorough knowledge of Basic Mathematics & Physics.

Course Objectives:

1. To prepare students to demonstrate basic knowledge in mathematics, science and engineering.
2. To prepare students to excel their the ability to identify, formulate and solve mechanical
3. Engineering problems.
4. To prepare students should be capable of self-education and clearly understand the value of life-long learning.
5. To prepare students, will be broadly educated and will have an understanding of the impact of engineering on society and demonstrate awareness of contemporary issues.
6. To inculcate in students, the ability to design a system to meet desired needs within environmental,
7. Economic, political, ethical health and safety, manufacturability and management knowledge and techniques to estimate time, resources to complete a project.

Course Outcomes:

1. An ability to apply knowledge of mathematics, science and engineering, to understand different materials and their properties.

2. An ability to design a system, component or process to meet desired needs within, realistic constraints such as economic , safety, manufacturability and sustainability etc.., while selecting a material to manufacture the designed components.
3. An ability to identify the phases and their interrelationship in different alloy systems.
4. A recognition of the need for, and an ability to engage in lifelong learning with the concepts of composite, ceramic and nano materials for practical application

UNIT – I

Ferrous And Non – Ferrous Metals And Alloys: Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheriodal graphite cast iron, Alloy cast irons. Classification of steels, structure and properties of plain carbon steels, Low alloy steels, Structure and properties of copper and its alloys, Aluminium and its alloys.

UNIT – II

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 important binary phase diagrams of Cu-Ni-, Al-Cu, Bi-Cd, Cu-An, Cus-Sn and Fe-Fe3C.

UNIT – III

Metals and Alloys: Heat treatment of steels, cold, hot working of metals, recovery, and recrystallization and grain growth. Microstructure, properties and applications of ferrous and non-ferrous alloys, Effect of alloying elements on Fe-Fe_3C system, Annealing, normalizing, Hardening, TTT diagrams, tempering, Hardenability, surface - hardening methods, Age hardening treatment, Cryogenic treatment of alloys.

UNIT – IV

Diffusion: Fick's laws and application of diffusion in sintering, doping of semiconductors and surface hardening of metals.

UNIT – V

Ceramics: Structure, properties, processing and applications of traditional and advanced ceramics.

Polymers: Classification, polymerization, structure and properties, additives for polymer products, processing and applications. Composites: Properties and applications of various composites.

TEXT BOOKS:

1. Introduction to Physical Metallurgy / Sidney H. Avener.
2. Essential of Materials Science and engineering/ Donald R. Askeland/Thomson.

3. Elements of Material Science / V. Rahghavan

REFERENCES:

1. Material Science and Metallurgy / Kodgire.
2. Science of Engineering Materials / Agarwal
3. Materials Science and Engineering / William and Callister.
4. An introduction to materials Science / W. G. Vinas & HL Mancini
5. Material science & material / C. D. Yesudian & Harris Samuel
6. Engineering Materials and Their Applications – R. A Flinn and P K Trojan / Jaico Books.
7. Engineering materials and metallurgy / R. K. Rajput/ S. Chand.

ME302ES: KINEMATICS OF MACHINES

B.Tech. II Year I Sem.

L	T	P	C
4	1	0	4

Prerequisites: Basic principles of mechanics

Course Overview:

Mechanical devices are designed to have mobility to perform certain functions. The theory behind the study of KOM leads us to design machines by understanding the relationship between the geometry and the movement of various parts of machine. This course will provide the knowledge on how to analyze the motions of mechanisms and design mechanisms to give required movement. This includes relative motion analysis and design of gears, gear trains, cams, linkages and steering gears by simultaneous graphical and analytical analysis of position, velocity, and acceleration of links in a machine.

Course Objective: The objectives of the course are to enable the student;

1. To understand the basic principles of kinematics and the related terminology of machines.
2. Discriminate mobility; enumerate links and joints in the mechanisms.
3. Formulate the concept of analysis of different mechanisms.
4. To understand the working of various straight line mechanisms, gears, gear trains, steering gear mechanisms, cams, and Hooke's joint.
5. Analyze a mechanism for displacement, velocity, and acceleration of links in a machine.

Course Outcomes: On successful completion of the course, the student will be able to

1. Be familiar with different machine elements which accomplish similar results.
2. Calculate mobility and enumerate rigid links and types of joints in mechanisms.
3. Able to create a schematic drawing of real world mechanisms.
4. Able to conduct a complete translational and rotational mechanism for the velocity and acceleration analysis.
5. Able to design mechanisms of basic cam systems for different machinery.

UNIT – I

Mechanisms: Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematics pairs –Types of constrained motion-kinetic chain-. Mechanism-machine-Structure - inversions of mechanism – inversions of quadric cycle chain, single and double slider crank chains, Mechanical Advantage - Grubler's Criterion.

UNIT – II

Kinematics: Velocity and acceleration – Motion of link in machine – Determination of Velocity and acceleration – Graphical method – Application of relative velocity method.

Plane Motion of Body: Instantaneous center of rotation- centrodes and axodes – Three centers in line theorem – Graphical determination of instantaneous center, determination of

angular velocity of points and links by instantaneous center method.
Kliens construction - Coriolis acceleration - determination of Coriolis component of acceleration. **Analysis of Mechanisms:** Analysis of slider crank chain for displacement-velocity and acceleration of slider – Acceleration diagram for a given mechanism.

UNIT – III

Straight-Line Motion Mechanisms: Exact and approximate copied and generated types – Peaucellier - Hart - Scott Russel – Grasshopper – Watt -Tchebicheff's and Robert Mechanism – Pantographs. **Steering Gears:** Conditions for correct steering – Davis Steering gear, Ackerman's steering gear. **Hooke's Joint:** Single and double Hooke's joint –velocity ratio – application – problems.

UNIT – IV

Cams: Definitions of cam and followers – their uses – Types of followers and cams – Terminology – Types of follower motion - Uniform velocity, Simple harmonic motion and uniform acceleration and retardation. Maximum velocity and maximum acceleration during outward and return strokes in the above 3 cases.
Analysis of Motion of Followers: Tangent cam with Roller follower – circular arc cam with straight, concave and convex flanks.

UNIT – V

Higher Pair: Friction wheels and toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion – velocity of sliding
Forms of teeth, cycloidal and involutes profiles – phenomena of interferences – Methods of interference. Condition for minimum number of teeth to avoid interference – expressions for arc of contact and path of contact of Pinion & Gear and Pinion & Rack Arrangements– Introduction to Helical – Bevel and worm gearing
Gear Trains: Introduction – Types – Simple – compound and reverted gear trains – Epicyclic gear train. Methods of finding train value or velocity ratio of Epicyclic gear trains. Selection of gear box - Differential gear for an automobile

TEXT BOOKS:

1. Theory of Machines and Mechanisms/JOSEPH E. SHIGLEY/Oxford/3rd Edition/International Edition
2. Theory of Machines / Thomas Bevan/Pearson/3rd Edition

REFERENCE BOOKS:

1. Theory of Mechanism and Machines /Jagdish Lal/Metropolitan Book Company
2. Theory of Machines /S. S. Rattan / Tata McGraw Hill Publishers.
3. Kinematics & Dynamics Of machinery/Norton/TMH
4. Theory of Machines / Sadhu Singh / Pearson.
5. Mechanism and Machine Theory / JS Rao and RV Duggipati / New Age
6. Theory of Machines by / R.K. Bansal (Lakshmi Publications).

ME303ES: MECHANICS OF SOLIDS

B.Tech. II Year I Sem.

L	T	P	C
3	0	0	3

Course Overview:

The study of Mechanics of solids often refers to various methods of calculating the stresses and strains in structural members, such as beams, columns, and shafts. The methods employed to predict the response of a structure under loading and its susceptibility to various failure modes takes into account the properties of the materials such as its yield strength, ultimate strength, Young's modulus, and Poisson's ratio. The stresses and strains that are developing within a mechanical member must be calculated in order to assess the load capacity of that member. This requires a complete description of the geometry of the member, its constraints, and the loads applied to the member and the properties of the material of which the member is composed.

Course Objectives: The objective is to learn the fundamental concepts of stress, strain, and deformation of solids with applications to bars, beams, and columns. Detailed study of engineering properties of materials is also of interest. Fundamentals of applying equilibrium, compatibility, and force-deformation relationships to structural elements are emphasized. The students are introduced to advanced concepts of flexibility and stiffness method of structural analysis. The course builds on the fundamental concepts of engineering mechanics course .

This course will advance the students' development of the following broad capabilities:

1. Students will be able to understand basic concepts of stress, strain and their relations based on linear elasticity. Material behaviors due to different types of loading will be discussed.
2. Students will be able to understand and know how to calculate stresses and deformation of a bar due to an axial loading under uniform and non-uniform conditions.
3. Students will understand how to develop shear-moment diagrams of a beam and find the maximum moment/shear and their locations
4. Students will understand how to calculate normal and shear stresses

Course Outcomes:

1. Analyze the behavior of the solid bodies subjected to various types of loading;
2. Apply knowledge of materials and structural elements to the analysis of simple structures;
3. Undertake problem identification, formulation and solution using a range of analytical methods;
4. Analyze and interpret laboratory data relating to behavior of structures and the materials they are made of, and undertake associated laboratory work individually and in teams.
5. Expectation and capacity to undertake lifelong learning

UNIT - I

Simple Stresses & Strains: Elasticity and plasticity – 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 between them – Bars of varying section – composite bars – Temperature stresses. Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

UNIT - II

Shear Force and Bending Moment : 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, u.d.l., uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT - III

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

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

UNIT - IV

Principal Stresses and Strains: Introduction – Stresses on an inclined section of a bar under axial loading – compound stresses – Normal and tangential stresses on an inclined plane for biaxial stresses – Two perpendicular normal stresses accompanied by a state of simple shear – Mohr's circle of stresses – Principal stresses and strains – Analytical and graphical solutions.

Theories of Failure: Introduction – Various theories of failure - Maximum Principal Stress Theory, Maximum Principal Strain Theory, Strain Energy and Shear Strain Energy Theory (Von Mises Theory).

UNIT - V

Torsion of Circular Shafts : Theory of pure torsion – Derivation of Torsion equations : $T/J = q/r = N\theta/L$ – Assumptions made in the theory of pure torsion – Torsional moment of resistance – Polar section modulus – Power transmitted by shafts – Combined bending and torsion and end thrust – Design of shafts according to theories of failure.

Thin Cylinders: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – changes in dia, and volume of thin cylinders– Thin spherical shells.

TEXT BOOKS:

1. Strength of materials – R.S. Kurmi and Gupta.

2. Solid Mechanics, by Popov
3. Strength of Materials – Ryder. G.H.; Macmillan Long Man Pub.
4. Strength of Materials – W.A. Nash, TMH

REFERENCES:

1. Strength of Materials -By Jindal, Umesh Publications.
2. Analysis of structures by Vazirani and Ratwani.
3. Mechanics of Structures Vol –I by H. J. Shah and S. B. Junnarkar, Charotar Publishing House Pvt. Ltd.
4. Strength of Materials by D.S Prakash Rao, Universities Press Pvt. Ltd.
5. Strength of Materials by S. S. Rattan, Tata McGraw Hill Education Pvt. Ltd.
6. Fundamentals of Solid Mechanics by M. L. Gambhir, PHI Learning Pvt. Ltd
7. Strength of Materials by R.K Rajput, S. Chand & Company Ltd.

ME304ES: THERMODYNAMICS

B.Tech. II Year II Sem.

L	T	P	C
3	0	0	3

Course Overview:

Thermodynamics is the field of physics that deals with the relationship between heat and work in a substance during a thermodynamic process. Specifically, thermodynamics focuses largely on how a heat transfer is related to various energy changes within a physical system undergoing a thermodynamic process. Such processes usually result in work being done by the system and are guided by the laws of thermodynamics. viz Laws of Thermodynamics: Zeroth Law of Thermodynamics-Two systems each in thermal equilibrium with a third system are in thermal equilibrium to each other. First Law of Thermodynamics - The change in the energy of a system is the amount of energy added to the system minus the energy spent doing work. Second Law of Thermodynamics - It is impossible for a process to have as its sole result the transfer of heat from a cooler body to a hotter one. Third Law of Thermodynamics - It is impossible to reduce any system to absolute zero in a finite series of operations. This means that a perfectly efficient heat engine cannot be created. Power cycles and refrigeration cycle based on thermodynamic system is studied.

Course Objectives:

1. To get the basic concepts of thermodynamics, temperature measurement ,first law and also ability to determine the heat , work in various flow & non-flow processes.
2. To gain the knowledge about second law of thermodynamics and determine the change in entropy, availability in various processes.
3. To get the knowledge various phases of pure substance and calculate its properties using steam tables and to determine properties of perfect gases in various processes.
4. To develop to learn the concepts of mixture of gases and to calculate the property values during a any process.
5. To get the knowledge about the working of different types of cycles and their performance.

Course Outcomes:

1. Demonstrate knowledge of energy transfer and work done and heat equation in different processes,
2. Power cycles and thermodynamic laws.
3. Demonstrate knowledge of ability to identify & apply fundamentals to solve problems like system
4. Properties, amount of work transfer and heat during various processes, steam properties at different temperatures and pressures using steam tables.
5. Demonstrate their knowledge & ability to design the thermal related components in various fields of
6. Energy transfer equipments.

7. An ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, and safety manufacturability and sustainability related thermal fields like I.C engines, different types of power plants etc.
8. The ability to use modern engineering tools, software and equipment to analyze energy transfer in required applications.
9. A knowledge of impact of engineering solutions on the society and also on contemporary issues related to different types of power cycles.
10. Recognition of the need for, and an ability to engage in self education and life-long learning.

UNIT – I

Introduction: Basic Concepts: System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Exact & Inexact Differentials, Cycle – Reversibility – Quasi – static Process, Irreversible Process, Causes of Irreversibility – Energy in State and in Transition, Types, Displacement & Other forms of Work, Heat, Point and Path functions, Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry – Reference Points – Const. Volume gas Thermometer – Scales of Temperature, Ideal Gas Scale- Joule's Experiments – First law of Thermodynamics – Corollaries – First law applied to a Process – applied to a flow system – Steady Flow Energy Equation.

UNIT - II

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 – Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations – Elementary Treatment of the Third Law of Thermodynamics

UNIT – III

Perfect Gas Laws – 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 – Vader Waals Equation of State – Compressibility charts – variable specific Heats – Gas Tables-

Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation Property tables. Mollier charts – Various Thermodynamic processes and energy Transfer – Steam Calorimetry.

UNIT - IV

Mixtures of perfect Gases – Mole Fraction, Mass friction 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 const. And Molecular Internal Energy, Enthalpy, sp. Heats and Entropy of Mixture of perfect Gases and Vapour, Atmospheric air - Psychrometric Properties – Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, Thermodynamic Wet Bulb Temperature, Specific Humidity, Relative Humidity, saturated Air, Vapour pressure, Degree of saturation – Adiabatic Saturation , Carrier's Equation – Psychrometric chart.

UNIT - V

Thermodynamic Cycles : Power cycles: Otto, Diesel, Dual Combustion cycles, Sterling Cycle, Atkinson Cycle, Ericsson Cycle, Lenoir Cycle – Description and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison of Cycles.

Refrigeration Cycles: Bell-Coleman cycle- Vapour compression cycle-performance Evaluation.

TEXT BOOKS:

1. Engineering Thermodynamics / PK Nag /TMH, 5th Edition
2. Engineering Thermodynamics/E Rathakrishnan/PHI/Second Edition/2013

REFERENCE BOOKS:

1. Engineering Thermodynamics/DP Mishra/ Cengage Learning/Second impression 2012
2. Thermodynamics – An Engineering Approach – Yunus Cengel & Boles /TMH
3. Thermodynamics – J. P. Holman / McGraw Hill
4. Engineering Thermodynamics – Jones & Dugan
5. Engineering Thermodynamics/P. Chattopadhyay/Oxford Higher Education/Revised First Edition
6. Thermodynamics & Heat Engines – Yadav – Central Book Depot, Allahabad.

ME308ES: METALLURGY AND MATERIAL SCIENCE LAB

B.Tech. II Year I Sem.

L	T	P	C
0	0	3	2

Course Objective: The purpose of this course is to make the students learn the concepts of Metallurgy and Material Science role in all manufacturing processes which convert raw materials into useful products adapted to human needs.

Course Outcomes: The Primary focus of the Metallurgy and Material science program is to provide undergraduates with a fundamental knowledge based associated materials properties, and their selection and application. Upon graduation, students would have acquired and developed the necessary background and skills for successful careers in the materials-related industries. Furthermore, after completing the program, the student should be well prepared for management positions in industry or continued education toward a graduate degree.

List of Experiments:

1. Preparation and study of crystal models for simple cubic, body centred cubic, face centred cubic and hexagonal close packed structures.
2. Preparation and study of the Microstructure of pure metals like Iron, Cu and Al.
3. Grain size measurement by different methods.
4. Preparation and study of the Microstructure of Mild steels, low carbon steels, high – C steels.
5. Study of the Microstructures of Cast Irons.
6. Study of Microstructures of different alloy steels.
7. Study of the Microstructures of Non-Ferrous alloys.
8. Study of the Microstructures of Heat treated steels.
9. Hardenability of steels by Jominy End Quench Test.
10. To find out the hardness of various heat treated and untreated plain carbon steels.

ME307ES: MECHANICS OF SOLIDS LAB

B.Tech. II Year I Sem.

L	T	P	C
0	0	3	2

Course Overview:

Mechanics of Solids lab deals with the experiments involving relation of externally applied loads and its internal effect on the bodies. In general study we assume bodies and objects to be rigid but in Mechanics of Solids lab we do consider the deformation/deflection. The lab involves analytical methods for determining the strength, stiffness (deformation characteristics), and stability of the various members in a structural system. The behavior of a member depends not only on the fundamental laws that govern the equilibrium of forces, but also on the mechanical characteristics of the material.

Course Objectives:

The objective is to learn the fundamental concepts of stress, strain, and deformation of solids with applications to bars, beams, and columns. Detailed study of engineering properties of materials is also of interest. Fundamentals of applying equilibrium, compatibility, and force-deformation relationships to structural elements are emphasized. The students are introduced to advanced concepts of flexibility and stiffness method of structural analysis. The course builds on the fundamental concepts of engineering mechanics course.

The students will advance the students' development of the following broad capabilities:

1. Students will be able to understand basic concepts of stress, strain and their relations based on linear elasticity. Material behaviors due to different types of loading will be discussed.
2. Students will be able to understand and know how to calculate stresses and deformation of a bar due to an axial loading under uniform and non-uniform conditions.
3. Students will understand how to develop shear-moment diagrams of a beam and find the maximum moment/shear and their locations
4. Students will understand how to calculate normal and shear stresses on any cross-section of a beam. Different cross-sections (including I-beam) will be discussed and applied Continuous Assessment Test 10 marks Mid Semester Test 15 marks End

Course Outcomes

1. Analyze the behavior of the solid bodies subjected to various types of loading.
2. Apply knowledge of materials and structural elements to the analysis of simple structures.
3. Undertake problem identification, formulation and solution using a range of analytical methods
4. Analyze and interpret laboratory data relating to behavior of structures and the materials they are made of, and undertake associated laboratory work individually and in teams.

5. Expectation and capacity to undertake lifelong learning.

Any 10 experiments from the following

1. Direct tension test
2. Bending test on Simple supported beam
3 Bending test on Cantilever beam
4. Torsion test
5. Brinell hardness test
6. Rockwell hardness test
7. Test on springs
8. Compression test on cube
9. Izod Impact test
10 .Charpy Impact test
11. Punch shear test

NT308ES: BASIC ELECTRICAL AND ELECTRONICS LAB

B.Tech. II Year I Sem.

L	T	P	C
0	0	3	2

Course Overview:

Verification of KCL and KVL, Magnetization characteristics of D.C. Shunt generator, Speed control of DC motor, Swinburne's Test on DC shunt machine, Brake test on DC shunt motor, OC and SC tests on Single-phase transformer, Brake test on 3-phase Induction motor, Regulation by an alternator by synchronous impedance method.PN Junction Diode Characteristics (Forward bias, Reverse bias) ,Transistor CE Characteristics (Input and Output),Study of CRO, Class A Power Amplifier, Zener Diode Characteristics, Transistor CE Characteristics, Rectifier without Filters (Full wave & Half wave),Rectifier with Filters (Full wave & half wave).

Course objectives:

1. The theoretical concepts of KVL and KCL, Diode, Transistor are verified experimentally
2. The performance of A.C and D.C machines are studied practically
3. The efficiency and regulation of Transformer are determined experimentally
4. The fundamentals of A.C. and D.C supply are studied practically.

Course Outcomes:

1. Find the difference between Generator and Motor performance characteristics
2. Find the applications of the electrical machines with the experimental determination of the performance of the machines
3. Find the applications of the Transformers with the experimental determination of the performance of the Transformers
4. Apply the Basic components to real time applications**.**

SECTION A: ELECTRICAL ENGINEERING:

1. Verification of KCL and KVL.
2. Magnetization characteristics of D.C. Shunt generator.
3. Speed control of DC motor.
4. Swinburne's Test on DC shunt machine.
5. Brake test on DC shunt motor.
6. OC and SC tests on Single-phase transformer.
7. Brake test on 3-phase Induction motor.
8. Regulation by an alternator by synchronous impedance method.

SECTION B: ELECTRONICS ENGINEERING:

1. PN Junction Diode Characteristics (Forward bias, Reverse bias)
2. Transistor CE Characteristics (Input and Output)
3. Study of CRO.

4. Class A Power Amplifier
5. Zener Diode Characteristics
6. Transistor CE Characteristics
7. Rectifier without Filters (Full wave & Half wave)
8. Rectifier with Filters (Full wave & half wave).

Note: Total 12 experiments are to be conducted.
(Six experiments from PART-A, Six experiments from PART-B)

MC300HS: GENDER SENSITIZATION LAB

B.Tech. II Year I Sem.

L	T	P	C
0	0	3	0

Course Objectives:

- To develop students' sensibility with regard to issues of gender in contemporary India.
- To provide a critical perspective on the socialization of men and women.
- To introduce students to information about some key biological aspects of genders.
- To expose the students to debates on the politics and economics of work.
- To help students reflect critically on gender violence.
- To expose students to more egalitarian interactions between men and women.

Course Outcomes:

- Students will have developed a better understanding of important issues related to gender in contemporary India.
- Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
- Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
- Students will acquire insight into the gendered division of labour and its relation to politics and economics.
- Men and women students and professionals will be better equipped to work and live together as equals.
- Students will develop a sense of appreciation of women in all walks of life.
- Through providing accounts of studies and movements as well as the new laws that provide protection and relief to women, the textbook will empower students to understand and respond to gender violence.

UNIT - I

UNDERSTANDING GENDER

Gender: Why Should We Study It? (*Towards a World of Equals*: Unit -1)

Socialization: Making Women, Making Men (*Towards a World of Equals*: Unit -2)

Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.

UNIT - II

GENDER AND BIOLOGY

Missing Women: Sex Selection and Its Consequences (*Towards a World of Equals*: Unit -4)

Declining Sex Ratio. Demographic Consequences.

Gender Spectrum: Beyond the Binary (*Towards a World of Equals*: Unit -10)

Two or Many? Struggles with Discrimination.

UNIT - III

GENDER AND LABOUR

Housework: the Invisible Labour (*Towards a World of Equals*: Unit -3)

"My Mother doesn't Work." "Share the Load."

Women's Work: Its Politics and Economics (*Towards a World of Equals*: Unit -7)

Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.

UNIT - IV

ISSUES OF VIOLENCE

Sexual Harassment: Say No! (*Towards a World of Equals*: Unit -6)

Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "*Chupulu"*.

Domestic Violence: Speaking Out (*Towards a World of Equals*: Unit -8)

Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading: New Forums for Justice.

Thinking about Sexual Violence (*Towards a World of Equals*: Unit -11)

Blaming the Victim-"I Fought for my Life…." - Additional Reading: The Caste Face of Violence.

UNIT - V

GENDER: CO - EXISTENCE

Just Relationships: Being Together as Equals (*Towards a World of Equals*: Unit -12)

Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Additional Reading: Rosa Parks-The Brave Heart.

TEXTBOOK:

All the five Units in the Textbook***, "Towards a World of Equals: A Bilingual Textbook on Gender"*** written by A. Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu and published by **Telugu Akademi, Hyderabad**, Telangana State in the year **2015**.

Note: Since it is an Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

REFERENCE BOOKS:

1. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
2. Abdulali Sohaila. *"I Fought For My Life…and Won*."Available online at: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

NT401ES: PRODUCTION TECHNOLOGY

B.Tech. II Year II Sem.

L	T	P	C
4	1	0	4

Course Overview:

Production technology is a combination of manufacturing technology with management science. A production engineer typically has a wide knowledge of engineering practices and is aware of the management challenges related to production. The goal is to accomplish the production process in the smoothest, most-judicious and most-economic way.

Production technology encompasses the application of castings, machining processing, joining processes, metal cutting & tool design, metrology, machine tools, machining systems, automation, jigs and fixtures, die and mould design, material science, design of automobile parts, and machine designing and manufacturing. Production engineering also overlaps substantially with manufacturing engineering and industrial engineering.

In industry, once the design is realized, production engineering concepts regarding work-study, ergonomics, operation research, manufacturing management, materials management, production planning, etc., play important roles in efficient production processes. These deal with integrated design and efficient planning of the entire manufacturing system, which is becoming increasingly complex with the emergence of sophisticated production methods and control systems.

Course objectives:

1. To reorganization of Practical orientation of Manufacturing Processes
2. Understand the basic parameters in the foundry section to producing various metallic parts.
3. Knowledge on different kinds of Production Processes and practices available for Shaping or Molding several daily used parts for industries.
4. Equipment selection for various deformation Processes will be understood.
5. Understand the various methods used to producing plastic shapes.

Course Outcomes:

1. An ability to contrast the different types of manufacturing process and apply the Technology Systems Model to manufacturing identify, illustrate, solve, formulate, distinguish & compare different working Process
2. An Ability to understand the design a system, component or process to meet desired needs within, realistic constraints such as manufacturability, economic, environmental, safety & sustainability etc.,
3. An ability to apply knowledge of mathematics, science, and engineering, to Identify, define, and clearly state a manufacturing design problem.

4. An ability to identify, formulates, analyzes, and solves Engineering Problems in Optimum time and ability to demonstrate ability to welding and conduct experiments, analyze and interpret data.
5. An ability to use the techniques, skills and modern engineering tools necessary for engineering practice with the concept of virtual work. Recognition of the need for, and an ability to engage in self education and life-long learning.

UNIT – I

Casting: Steps involved in making a casting - Its applications - Patterns and Types of patterns – Pattern allowances and their construction. Types of casting processes –Solidification of casting.

UNIT – II

Welding: welding Types - Oxy-fuel gas cutting – standard time and cost calculations. Arc welding, forge welding – Resistance welding, Thermit welding.

UNIT – III

Inert Gas Welding, TIG Welding, MIG welding, Friction welding, induction welding, explosive welding, Laser Welding, Laser Welding Soldering and Brazing, Heat affected zone in welding. Welding defects – causes and remedies – destructive and non- destructive testing of welds.

UNIT – IV

Hot working, cold working, strain hardening, recovery, recrystallisation and grain growth, Comparison of properties of Cold and Hot worked parts, Rolling fundamentals – theory of rolling, types of Rolling mills and products. Forces in rolling and power requirements

Stamping, forming and other cold working processes : Blanking and piercing – Bending and forming – Drawing and its types – wire drawing and Tube drawing – coining – Hot and cold spinning – Types of presses and press tools. Forces and power requirement for the above operations.

UNIT – V

Extrusion of Metals: Basic extrusion process and its characteristics. Hot extrusion and cold extrusion - Forward extrusion and backward extrusion – Impact extrusion – Extruding equipment – Tube extrusion and pipe making, Hydrostatic extrusion. Forces in extrusion

Forging Processes: Forging operations and principles – Tools – Forging methods – Smith forging, Drop Forging – Roll forging. **Forging hammers**: Rotary forging – forging defects – cold forging, swaging, Forces in forging operations.

TEXT BOOKS:

1. Manufacturing Technology (Vol.1) / P.N. Rao/TMH/2nd Edition
2. Workshop Technology (Vol.1) /Hajra Chowdary/Asia Publishing House/2nd Edition

REFERENCE BOOKS:

1. Production Technology /Sarma P C /S. Chand
2. Production Technology / R.K. Jain/Khanna Publishers
3. Metal Casting / T.V Ramana Rao / New Age
4. Principles of Metal Castings / Rosenthal/TMH
5. A Course in Workshop Technology/B.S. Raghuwamshi /Dhanpat rai & Sons
6. Manufacturing Engineering and Technology/Kalpakjin S/ Pearson Edu.

NT402ES: DESIGN OF MACHINE MEMBERS - I

B.Tech. II Year II Sem.

L	T	P	C
4	1	0	4

Course Overview:

This course deals the Systematic approach to design, standardization, Design and Manufacturing, Engineering Materials, Simple Stresses and Compound Stresses in Machine Elements, Design For Strength, strength of mechanical elements; theories of failure under static and dynamic loading situations; impact loading, Design of Fasteners, Design of joints, Design Of Keys and cotter joints, Shaft Couplings, Rivet Joints, Welded Joints, Design of Springs and Shafts.

Course Objectives:

1. To enhance the ability of students to apply mathematics and fundamentals of science for design Machine elements.
2. To develop good and careful problem formulation and solution skills for designing selected machine components and systems.
3. To develop an ability to make proper analysis and assumptions by employing the concepts and theories.
4. To develop a working knowledge in the use of various standard procedures and catalog information in the identification and selection of engineering materials.

Course Outcomes:

1. Students should be able to understand design and manufacturing considerations
2. Students should be able to understand Engineering materials and their properties, BIS codes for steels
3. Students should be able to understand stresses in machine members
4. Students should be able to understand Fatigue loading, stress concentration, endurance limit, theories of failure.
5. Students should be able to understand riveted joints, bolted joints, cotter, knuckle joints, keys, couplings
6. Students should be able to understand stresses and design of shaft
7. Students should be able to understand deflections in springs.
8. Students Can participate and succeed in competitive examinations like GATE, IES

UNIT - I

Introduction: General considerations. Classification of Machine Design. Steps involved in Machine Design.

Stresses in Machine Members: Simple stresses, Combined stresses, Torsional and bending stresses, impact stresses, stress strain relation, various theories of failure, factor of safety, Design for strength and rigidity, preferred numbers. The concept of stiffness in tension, bending, torsion, and combined situations, Static strength design based on fracture toughness.

UNIT - II

Strength Of Machine Elements : Stress concentration ,Theoretical stress Concentration factor, Fatigue stress concentration factor notch sensitivity , Design for fluctuating stresses , Endurance limit , Estimation of Endurance strength , Goodman's line , Soderberg's line , Modified Goodman's line.

UNIT - III

Riveted and Welded Joints: Design of joints with initial stresses, eccentric loading

Bolted Joints: Design of bolts with pre-stresses, Design of joints under eccentric loading, locking devices, both of uniform strength, different seals.

UNIT - IV

Keys, Cotters And Knuckle Joints, Shafts: Design of Keys, stresses in keys, cottered joints, spigot and socket, sleeve and cotter, jib and cotter joints- Knuckle joints.

Shafts: Design of solid and hollow shafts for strength and rigidity, Design of shafts for combined bending and axial loads, Shaft sizes, BIS code. Use of internal and external circlips, Gaskets, and seals (stationary & rotary).

UNIT - V

Shaft Coupling: Rigid couplings, Muff, Split muff and Flange couplings. Flexible couplings, Flange coupling (Modified)

Mechanical Springs: Stresses and deflections of helical springs, Extension, compression springs, Springs for fatigue loading, natural frequency of helical springs, Energy storage capacity, helical torsion springs, Co-axial springs, leaf springs.

TEXT BOOKS

1. V. Bandari (2011), A Text Book of Design of Machine Elements, 3rd edition, Tata McGraw hill education (P) ltd, New Delhi, India.
2. R. L. Norton (2006), Machine Design (An Integrated approach), 2nd edition, Pearson Publishers, Chennai, India.

REFERENCE BOOKS

1. Shigley, J.E, (2011), Mechanical Engineering Design, 9th Edition, Tata McGraw-Hill, New Delhi, India.
2. S. M.D. Jalaludin, (2011), Machine Design, 3rd Edition, Anuradha Publishers, Kumbakonam, Chennai, India.
3. P. Kannaiah, (2012), Machine Design, 2nd Edition, Scitech Publications India Pvt. Ltd, New Delhi, India.

ME401ES: FLUIDS MECHANICS AND HYDRAULIC MACHINES

B.Tech. II Year II Sem.

L	T	P	C
4	1	0	4

Course Overview:

The aim of this course is to introduce basic principles of fluid mechanics and it is further extended to cover the application of fluid mechanics by the inclusion of fluid machinery. Nowadays the principles of fluid mechanics find wide applications in many situations. The course deals with the fluid machinery, like turbines, pumps in general and in power stations. This course also deals with the large variety of fluids such as air, water, steam, etc; however the major emphasis is given for the study of water

Course Objectives: The objectives of the course are to enable the student;

1. To understand the basic principles of fluid mechanics
2. To identify various types of flows
3. To understand boundary layer concepts and flow through pipes
4. To evaluate the performance of hydraulic turbines
5. To understand the functioning and characteristic curves of pumps

Course Outcomes:

1. Able to explain the effect of fluid properties on a flow system.
2. Able to identify type of fluid flow patterns and describe continuity equation.
3. To analyze a variety of practical fluid flow and measuring devices and utilize fluid Mechanics principles in design.
1. To select and analyze an appropriate turbine with reference to given situation in power plants.
4. To estimate performance parameters of a given Centrifugal and Reciprocating pump.
5. Able to demonstrate boundary layer concepts.

UNIT - I

Fluid statics: Dimensions and units: physical properties of fluids- specific gravity, viscosity, and surface tension - vapour pressure and their influence on fluid motion- atmospheric, gauge and vacuum pressures – measurement of pressure- Piezometer, U-tube and differential manometers.

UNIT - II

Fluid kinematics: Stream line, path line and 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 and three dimensional flows.

Fluid dynamics: Surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its application on force on pipe bend.

UNIT - III

Boundary Layer Concepts: Definition, thicknesses, characteristics along thin plate, laminar and turbulent boundary layers (No derivation) boundary layer in transition, separation of boundary layer, submerged objects – drag and lift.

Closed conduit flow: Reynold's experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel- total energy line-hydraulic gradient line. Measurement of flow: Pitot tube, venturi meter, and orifice meter, Flow nozzle

UNIT - IV

Basics of turbo machinery : 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.

Hydraulic Turbines : Classification of turbines, Heads and efficiencies, 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, surge tank, water hammer.

UNIT - V

Centrifugal pumps: Classification, working, work done – barometric head- losses and efficiencies specific speed- performance characteristic curves, NPSH.

Reciprocating pumps: Working, Discharge, slip, indicator diagrams.

TEXT BOOKS:

1. Hydraulics, fluid mechanics and Hydraulic machinery MODI and SETH.
2. Fluid Mechanics and Hydraulic Machines by Rajput.

REFERENCES:

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria & Sons.
2. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International.
3. Hydraulic Machines by Banga & Sharma, Khanna Publishers.

NT403ES: DYNAMICS OF MACHINES

B.Tech. II Year II Sem.

L	T	P	C
3	0	0	3

Course Overview:

This course expands on the mechanical engineering student's background in dynamic synthesis and analysis by providing significant skills and experience in creating and modeling mechanisms. This course is intended to deal with the forces and their effects, while acting upon the machine parts in motion. The knowledge of this subject is very essential for an engineer in designing the various parts of a machine. Study of applications of gyroscopes is very helpful to learn the precession and its effect on automobiles. The study of dynamics of machinery is an applied field of mechanical engineering that is concerned with understanding the relationship between the geometry and the motions of the parts of a machine and the forces that produce this motion. This course helps to learn how to analyze the motions of mechanisms, design mechanisms to have given motions, and analyze forces in machines. Application of vibrations to the analysis and design of machines and mechanical components.

Course Objectives:

1. The objectives of the course are to enable the student to have;
2. An ability to derive frictional forces on bodies in motion by applying knowledge of mathematics and mechanics.
3. An ability to design and conduct experiments on gyroscopes, as well as to analyze and interpret data.
4. An ability to design, formulate, and solve engineering problems on clutches and brakes.
5. An ability to understand the purpose of dynamometers and find the power of an engine.
6. An ability to balance both the rotating and reciprocating masses.
7. An ability to study the vibrations of beams and springs when masses are attached
8. To enhance the ability of students to work in teams, establish the leadership role.
9. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
10. Recognition of the need for, and an ability to engage in life-long learning.
11. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Course Outcomes: After completing this course the student must demonstrate the knowledge and ability to:

1. Analyze Dynamics of the three-dimensional particle motion in various coordinate systems: Cartesian, natural, and cylindrical.
2. Ability to learn the concepts of gyroscopic effects and effect of precision motion on the stability of moving vehicles.

3. Ability to learn the concepts of static and dynamic force analysis of planar mechanisms.
4. Understanding of the concepts of friction-clutches, brakes and dynamometers and its importance.
5. Understanding the importance of turning moment diagrams, fly wheels and governors its analysis.
6. Ability to understand concepts of various balancing of rotary and reciprocating mass.
7. Understanding of the concepts of vibrations and simple problems on forced damped vibrations.
8. Able to communicate effectively in both verbal and written form.
9. Understanding of impact of engineering solutions on the society and also will be aware of contemporary issues.
10. Develop confidence for self education and ability for life-long learning. 11. Can participate and succeed in competitive examinations like GATE, GRE.

UNIT – I

Angular Motion: Gyroscopes – effect of precession – motion on the stability of moving vehicles such as motorcycle – motorcar – aero planes and ships. Static and Dynamic Force Analysis of planar mechanisms.

UNIT – II

Friction: Inclined plane – Friction of screw and nuts - Pivots and collars – uniform pressure, uniform wear – friction circle and friction axis: lubricated surfaces – boundary friction – film lubrication. Clutches, Single plate, multi plate, cone clutch, centrifugal clutches.

Brakes and Dynamometers: Simple block brake - Internal expanding brake- band brake of vehicle. Dynamometers – absorption and transmission types. General description and methods of operation.

UNIT – III

Turning Moment Diagram and Flywheels: Turning moment- Inertia torque-connecting rod angular velocity and acceleration-crank effort and torque diagrams-fluctuation of energy – flywheels and their

Governors: Watt, Porter and Proell governors- Spring loaded governors – Hartnell and Hartung with auxiliary springs- Sensitiveness, isochronisms and hunting– effort and power of the governors.

UNIT – IV

Balancing: Balancing of rotating masses- Primary, Secondary, and higher balancing of reciprocating masses. Analytical and graphical methods. Unbalanced forces and couples. Examination of “V” and multi cylinder in-line and radial engines for primary and secondary balancing- locomotive balancing – Hammer blow – Swaying couple – variation of tractive effort.

UNIT – V

Vibrations: Free Vibration of mass attached to vertical spring –oscillation of pendulums-Transverse loads – vibrations of beams with concentrated and distributed loads. Dunkerly's method – Raleigh's method. Whirling of shafts – critical speed – torsional vibrations – one, two and three rotor systems.

TEXT BOOKS:

1. Theory of Machines/ S. S. Rattan/McGraw Hill.
2. Theory of Mechanism and Machines /Jagadish Lal/Metropolitan Book Company

REFERENCE BOOKS:

1. Theory of Machines/ Shigley/ Mc Graw Hill Publishers
2. Theory of Machines/ Thomas Bevan/Pearson

SM405MS: BUSINESS ECONOMICS AND FINANCIAL ANALYSIS

B.Tech. II Year II Sem.

L	T	P	C
3	0	0	3

Course Objective: To learn the basic Business types, impact of the Economy on Business and Firms specifically. To analyze the Business from the Financial Perspective.

Course Outcome: The students will understand the various Forms of Business and the impact of economic variables on the Business. The Demand, Supply, Production, Cost, Market Structure, Pricing aspects are learnt. The Students can study the firm's financial position by analysing the Financial Statements of a Company.

UNIT – I

Introduction to Business and Economics:

Business: Structure of Business Firm, Theory of Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company, Non-Conventional Sources of Finance.

Economics: Significance of Economics, Micro and Macro Economic Concepts, Concepts and Importance of National Income, Inflation, Money Supply in Inflation, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature of Business Economics.

UNIT – II

Demand and Supply Analysis:

Elasticity of Demand: Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making, Demand Forecasting: Characteristics of Good Demand Forecasting, Steps in Demand Forecasting, Methods of Demand Forecasting.

Supply Analysis: Determinants of Supply, Supply Function & Law of Supply.

UNIT - III

Production, Cost, Market Structures & Pricing:

Production Analysis: Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Different Types of Production Functions.

Cost analysis: Types of Costs, Short run and Long run Cost Functions.

Market Structures: Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, and Monopolistic Competition.

Pricing: Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, and Cost Volume Profit Analysis.

UNIT - IV

Financial Accounting: Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, and Preparation of Final Accounts.

UNIT - V

Financial Analysis through Ratios:

Concept of Ratio Analysis, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios (simple problems).

Introduction to Fund Flow and Cash Flow Analysis (simple problems).

TEXT BOOKS:

1. D. D. Chaturvedi, S. L. Gupta, Business Economics - Theory and Applications, International Book House Pvt. Ltd. 2013.
2. Dhanesh K Khatri, Financial Accounting, Tata McGraw Hill, 2011.
3. Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, Managerial Economics, 2e, Tata McGraw Hill Education Pvt. Ltd. 2012.

REFERENCES:

1. Paresh Shah, Financial Accounting for Management 2e, Oxford Press, 2015.
2. S. N. Maheshwari, Sunil K Maheshwari, Sharad K Maheshwari, Financial Accounting, 5e, Vikas Publications, 2013.

NT406ES: PRODUCTION TECHNOLOGY LAB

B.Tech. II Year II Sem.

L	T	P	C
0	0	3	2

Course Objectives: To make the student to know;

- Design and manufacture of simple patterns
- Sand testing
- Arc welding, gas welding and resistance welding equipment for the fabrication of welded joints
- Pipe bending and injection molding equipment

Course Outcomes: The student will be able to:

- Design and manufacture simple patterns
- Control sand properties in foundry
- Operate arc welding, gas welding and resistance welding equipment
- Use pipe bending and injection moulding equipment

Minimum of 12 Exercises need to be performed

I. METAL CASTING LAB:

1. Pattern Design and making - for one casting drawing.
2. Sand properties testing - Exercise -for strengths, and permeability – 1
3. Moulding Melting and Casting - 1 Exercise

II WELDING LAB:

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

III 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

IV PROCESSING OF PLASTICS

1. Injection Moulding
2. Blow Moulding

REFERENCE BOOK:

1. Dictionary of Mechanical Engineering – G.H.F. Nayler, Jaico Publishing House.

ME407ES: FLUID MECHANICS AND HYDRAULIC MACHINES LAB

B.Tech. II Year II Sem.

L	T	P	C
0	0	3	2

Course Overview:

The aim of this course is to introduce basic principles of fluid mechanics and it is further extended to cover the application of fluid mechanics by the inclusion of fluid machinery. Nowadays the principles of fluid mechanics find wide applications in many situations. The course deals with the fluid machinery, like turbines, pumps in general and in power stations. This course also deals with the large variety of fluids such as air, water, steam, etc; however the major emphasis is given for the study of water.

Course Objectives:

- To understand the basic principles of fluid mechanics.
- To identify various types of flows.
- To understand boundary layer concepts and flow through pipes.
- To evaluate the performance of hydraulic turbines.
- To understand the functioning and characteristic curves of pumps.

Course Outcomes:

- Able to explain the effect of fluid properties on a flow system.
- Able to identify type of fluid flow patterns and describe continuity equation.
- To analyze a variety of practical fluid flow and measuring devices and utilize fluid mechanics principles in design.
- To select and analyze an appropriate turbine with reference to given situation in power plants.
- To estimate performance parameters of a given Centrifugal and Reciprocating pump.
- Able to demonstrate boundary layer concepts

List of Experiments

1. Impact of jets on Vanes.
2. Performance Test on Pelton Wheel.
3. Performance Test on Francis Turbine.
4. Performance Test on Kaplan Turbine.
5. Performance Test on Single Stage Centrifugal Pump.
6. Performance Test on Multi Stage Centrifugal Pump.
7. Performance Test on Reciprocating Pump.
8. Calibration of Venturimeter.
9. Calibration of Orifice meter.
10. Determination of friction factor for a given pipe line.
11. Determination of loss of head due to sudden contraction in a pipeline.
12. Verification of Bernoulli's Theorems

Note: Any 10 of the above 12 experiments are to be conducted.

NT408ES: DYNAMICS OF MACHINES LAB

B.Tech. II Year II Sem.

L	T	P	C
0	0	3	2

Note: Minimum of 12 Exercises need to be performed

Course Overview:
By the end of the course student will be able to perform vibration analysis, balancing system and Trajectory planning of a robot in joint space scheme..

Course Objectives:
To create awareness on various vibration systems, gyroscopic couple, natural frequency and FFT analyzer.

Course Outcomes: At the conclusion of the course, students will have:

1. An understanding of the basic performance of steady state amplitude of a forced vibratory system
2. An understanding of the performance of Static balancing using steel balls
3. An understanding of basic Direct Kinematic analysis of a robot
4. An understanding of good laboratory practice.
5. An ability to prepare effective written reports on the performance Palletizing operation using Robot programming

List of Experiments:

1. Determination of damped natural frequency of vibration of the vibrating system with different viscous oils.
2. Determination of steady state amplitude of a forced vibratory system.
3. Static balancing using steel balls.
4. Determination of the magnitude and orientation of the balancing mass in dynamic balancing.
5. Field balancing of the thin rotors using vibration pickups.
6. Determination of the magnitude of gyroscopic couple, angular velocity of precession and representation of vectors.
7. Determination of natural frequency of given structure using FFT analyzer.
8. Diagnosis of a machine using FFT analyzer.
9. Direct Kinematic analysis of a robot.
10. Inverse Kinematic analysis of a robot.
11. Trajectory planning of a robot in joint space scheme.
12. Palletizing operation using Robot programming.

MC400ES: ENVIRONMENTAL SCIENCE AND TECHNOLOGY

B.Tech. II Year II Sem.

L	T	P	C
3	0	0	0

Course Objectives:

- Understanding the importance of ecological balance for sustainable development.
- Understanding the impacts of developmental activities and mitigation measures
- Understanding the environmental policies and regulations

Course Outcomes: Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn helps in sustainable development

UNIT - I

Ecosystems: Definition, Scope and Importance of ecosystem. Classification, structure and function of an ecosystem, Food chains, food webs and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnification, ecosystem value, services and carrying capacity, Field visits.

UNIT - II

Natural Resources: Classification of Resources: Living and Non-Living resources, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non renewable energy sources, use of alternate energy source, case studies.

UNIT - III

Biodiversity And Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

UNIT - IV

Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics

of e-Waste and its management. **Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary.
Overview of air pollution control technologies, Concepts of bioremediation. **Global Environmental Problems and Global Efforts: C**limate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol and Montréal Protocol.

UNIT - V

Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio-economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP). **Towards Sustainable Future:** Concept of Sustainable Development, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

SUGGESTED TEXT BOOKS:

1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
2. Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE BOOKS:

1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.