Gayatri Vidya Parishad College for Degree and PG Courses(A)

Department of Mechanical Engineering

Accredited by NBA and NAAC

Syllabus for II-year Mechanical Engineering

(Autonomous stream admitted for the year 20119-2020)

Semester III (Second year)

Sl. No.	Category	Code	Course Title	Hours per week			Allotment of Marks		Total Marks	Credits
				Lecture	Tutorial	Practical	Internal	External		
1	Basic Science Course	1995301	Mathematics-4	3	0	0	30	70	100	3
2	Basic Science Course	1995302	Engineering mechanics-II	3	0	0	30	70	100	3
3	Mandatory course	1995303	Environmental Science	2	0	0	30	70	100	0
4	Professional Core Course	1995304	Mechanics of Solids-I	3	0	0	30	70	100	3
5	Professional Core Course	1995305	Basic Thermodynamics	3	0	0	30	70	100	3
6	Professional Core Course	1995306	Manufacturing Processes	3	0	0	30	70	100	3
7	Humanities and Social Sciences Course	1995307	Universal Human Values-2	3	0	0	30	70	100	3
8	Engineering Science Course	1995302P	Fuels and Mechanics lab			3	50	50	100	1.5
9	Professional Core Course	1995304P	Mechanics of Solids Lab			3	50	50	100	1.5
			Total	**20**	**0**	**6**	**310**	**490**	**800**	**21**

Semester IV (Second year)

Sl. No.	Category	Code	Course Title	Hours per week			Allotment of Marks		Total Marks	Credits
				Lecture	Tutorial	Practical	Internal	External		
1	Professional Core course	1995401	Mechanics of Solids-2	3	0	0	30	70	100	3
2	Professional Core course	1995402	Theory of Machines - 1	3	0	0	30	70	100	3
3	Professional Core course	1995403	Metal cutting &Machine tools	3	0	0	30	70	100	3
4	Professional Core Course	1995404	Fluid Mechanics	3	0	0	30	70	100	3
5	Professional Core course	1995405	Metallurgy and Material science	2	0	0	30	70	100	2
6	Engineering Science Course	1995406	Electrical and Electronics Engg.	3	0	0	30	70	100	3
7	Professional Core Course	1995403 P	Manufacturing Technology Lab-I	0	0	3	50	50	100	1.5
8	Professional Core Course	1995407	Mechanical Engineering Drawing	0	0	3	50	50	100	1.5
9	Engineering Science Course	1995406 P	Electrical and Electronics Lab	0	0	3	50	50	100	1.5
			Total	**17**	**0**	**9**	**330**	**570**	**900**	**21.5**

MATHEMSTICS-IV

Code Number **1995301**	Course	L	T	P	Allotment of Marks		Total Marks	Ext. Exam Time	C
		Hours per week			Ses.	Ext.			
	B.TECH(II/IV)	**3**	**1**	**0**	30	70	100	3 Hrs	**3**

L: Lectures; T: Tutorial; P: Practical; Ses: Sessionals; Ext: External; C: Credits

OBJECTIVES: In general, the students are introduced with a knowledge on - Vector Calculus, Partial differential equations, their applications and Integral Transforms (Fourier transforms, FST, FCT) to facilitate them to use these concepts in their core subjects.

COURSE OUTCOMES:

CO1	Evaluate the multiple integrals and apply the concept to find areas, volumes, centre of mass and Gravity for cubes, sphere and rectangular parallelepiped.
CO2	Evaluate the line, surface and volume integrals and converting them from one to another.
CO3	Identify solution methods for partial differential equations that model physical process and find the general solution of the Partial Differential Equations bearing applications.
CO4	Analyze displacements of one dimensional wave and distribution of one dimensional heat equation.
CO5	Express any periodic function by using Fourier series and a non-periodic function by using Fourier transforms.

Unit-I : VECTOR CALCULUS-1

Differentiation of vectors, curves in space, velocity and acceleration, relative velocity and relative acceleration, scalar and vector point functions, vector operator □ applied to scalar point functions- gradient, □ applied to vector point functions- divergence and curl. Physical interpretation of gradient, divergence and culrl (i.e., $\square f$, $\square . \overline{F}$, $\square \square \overline{F}$), Irrotational and

Solenoidal fields, the relations obtained after □ applied twice to point functions, □ applied to products of two functions.

Unit-II : VECTOR CALCULUS-2

Integration of vectors, line integral, circulation, work done, surface integral-flux, Green's theorem in the plane, Stoke's theorem, volume integral, Gauss Divergence theorem.
Introduction of orthogonal curvilinear coordinates, cylindrical and spherical polar coordinates

Unit-III : INTRODUCTION OF PARTIAL DIFFERENTIAL EQUATIONS

Formation of partial differential equations, solutions of partial differential equations- equations solvable by direct integration, linear equations of first order: Lagrange's Linear equation, non-linear equations of first order, Charpit's method.

Homogeneous linear equations with constant coefficients- rules for finding the complementary function, rules for finding the particular integral (working procedure), non- homogeneous linear equations.

Unit-IV : APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

Method of separation of variables, One dimensional wave equation-vibrations of a stretched string, one dimensional Heat flow equation, Two dimensional heat flow in steady state - solution of Laplace's equation in Cartesian and polar coordinates (two dimensional).

Unit-V : INTEGRAL TRANSFORMS

Introduction, definition, Fourier integral, Sine and Cosine integrals, Complex form of Fourier integral, Fourier transform, Fourier Sine and Cosine transforms, Finite Fourier Sine and Cosine transforms, properties of Fourier transforms.

Convolution theorem for Fourier transforms, Parseval's identity for Fourier transforms, Fourier transforms of the derivatives of a function, simple applications to Boundary value problems.

TEXT BOOKS:

Scope and treatment as in "Higher Engineering Mathematics", by Dr. B.S.Grewal, **43rd Edition**, Khanna Publishers.

REFERENCE BOOKS:

1. A text book of Engineering Mathematics by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw Hill Company.
4. Advanced Engineering Mathematics by H.K.Dass. S.Chand Company.

ENGINEERING MECHANICS – II

Course code	Title of the course	Contact periods for delivering the course	Credits
1995302	ENGINEERING MECHANICS – II	L T P 3 0 0	Credits: 3

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

CO 1	Analyze the rectilinear motion of a particle and rigid body under the study of kinematics and kinetics and to use D'Alembert's principle, work-energy theorem and impulse-momentum principle to solve kinetics problems according to the need of their application.
CO 2	Analyze the curvilinear motion of a particle and rigid body under the study of kinematics and kinetics and to use D'Alembert's principle and work-energy theorem to solve kinetics problems according to the need of their application.
CO 3	Study kinematics and kinetics of rigid bodies in rotation about a fixed axis and to apply D'Alembert's principle to solve rotational kinetics problems.
CO 4	Analyze the plane motion of a particle and rigid body under the study of kinematics and kinetics and to use D'Alembert's principle, work-energy theorem and angular-momentum principle to solve kinetics problems according to the need of their application.
CO5	Study and analyze free vibrations using equilibrium method and energy method for various spring-mass systems and also analyze the motion of simple pendulum, compound pendulum and torsional pendulum.

Note:L – Lecture periods; T- Tutorial periods; P- Practical periods

Unit- I:

Rectilinear Translation: Introduction to kinematics and kinetics – Kinematics of rectilinear motion – Principles of dynamics- Differential equation of rectilinear motion- Motion of a particle acted upon by a constant force, Force as a function of time- D'Alembert's principle in rectilinear motion–Work and energy- conservation of energy – work-energy equation for translation - Momentum and impulse – Conservation of linear momentum–Impulse-momentum equation for translation–Impact – types of collisions –Coefficient of restitution – Elastic collisions.

Unit- II:

Curvilinear Translation: Kinematics of curvilinear motion-Rectangular components of curvilinear motion - Normal and tangential components of acceleration - Differential equations of curvilinear motion - Motion of a projectile- D'Alembert's principle in curvilinear motion- Moment of momentum- work and energy in curvilinear motion.

Unit- III:

Rotation of Rigid bodies about a fixed axis: Kinematics of rotation - Equation of motion for a rigid body rotating about a fixed axis- Rotation under the action of a constant moment -D'Alembert's principle in rotation - Energy equation for rotating bodies.

Unit- IV:

Plane motion of a rigid body: Kinematics of plane motion- Instantaneous center-Equations of plane motion- D'Alembert's principle in plane motion- The principle of angular momentum in plane motion- Energy equation for plane motion.

Unit-V:

Mechanical Vibrations: Introduction to mechanical vibrations- types of vibrations – simple harmonic motion -Force proportional to displacement - Free vibrations (without damping)- Natural frequency of free longitudinal vibrations using equilibrium method, energy method – spring-mass system – simple pendulum – Compound pendulum - General case of moment proportional to angle of rotation – Torsional vibrations – Torsional pendulum

Text Book:

1. Engineering Mechanics (In S.I Units) (5^{th} edition) by S. Timoshenko, D.H.Young , J.V. Rao , Sukumar Pati , TMH publications.
2. Engineering Mechanics – Statics and Dynamics by A.Nelson, TMH publications
3. Singer's Engineering Mechanics Statics and Dynamics, (3rd edition) by Vijaya Kumar Reddy, K. and Suresh Kumar. J., BS Publications.

References:

1. Engineering Mechanics – Dynamics(9^{th} edition)by J.L. Meriam and L.G. Kraige, Wiley
2. Engineering Mechanics – Statics and Dynamics (14^{th} edition) by A.K.Tayal, Umesh Publications
3. Engineering Mechanics by Bhavikatti, S.S. and Rajasekharappa, J.G., New Age International Publications

ENVIRONMENTAL SCIENCES

Course code	Title of the course	Contact periods for delivering the course	Credits
1995303	ENVIRONMENTAL SCIENCES	L T P 2 0 0	Credits: 0

Course Outcomes

CO 1: In this unit the students learn about the scope and importance of Environmental studies. The students understand about different kinds of ecosystems.

CO 2: The students learn about biodiversity and its conservation. They also learn about types of biodiversity, values of biodiversity and threats to biodiversity.

CO 3: The students understand about the types of natural resources and problems associated with them.

CO 4: In this unit the students gain knowledge about different types of environmental pollutions, their causes, effects and control measures.

CO 5: In this unit the students gain knowledge about characteristics of human population growth and its impact on environment. The students develop deep understanding about the environmental legislation.

Unit I

Introduction to Environmental studies and Ecosystems

Definition, Scope and importance of environmental studies. Concept of an Eco system , Biotic and Abiotic components of ecosystem, structure and function of an ecosystem. Food Chains, Food webs and Ecological Pyramids Forest ecosystem, Grassland ecosystem, Desert ecosystem, Pond ecosystem and Marine ecosystem.

Unit II

Bio-Diversity and its Conservation

Introduction – Definition and types of biodiversity – value of biodiversity - India as mega diversity nation – Hot spots of biodiversity – Threats to biodiversity – Conservation methods of biodiversity – In-situ & Ex – situ methods of conservation - Concept of sustainable development.

Unit III

Environment and Natural Resources Management

Soil erosion and desertification, Effects of modern agriculture, fertilizer-pesticide problems, Forest Resources: Use and over-exploitation, Mining and dams – their effects on forest and tribal people, Water resources : Use and over-utilization of surface and ground water, Floods, droughts, Water logging and salinity, Dams – benefits and costs, Conflicts over water, Energy Resources : Energy needs, Renewable and non-renewable energy sources.

Unit IV

Environmental Pollution – climate change and environmental problems

Definition, causes, effects and control measures of (a) air pollution (b) water pollution (c) soil pollution (d) noise pollution. Global Warming – Acid Rain – Ozone depletion – Photochemical Smog.

Drinking water, Sanitation and public health, Effect of activities of the quality of environment Urbanization, transportation, Industrialization. Water scarcity and ground water depletion, Controversies on major dams –resettlement and rehabilitation of people problems and concerns,

Unit V :

Human Population and Environmental legislations

Population Explosion – characteristics of population explosion. Impact of population growth on Environment – Role of Information technology in Environment and Human Health Environmental Ethics.

Environmental acts: Water (Prevention and control of pollution) act, air (Prevention and control of pollution) act, Environmental Protection Act, Wild life protection act, Forest conservation act.

Textbooks : Anubha Kaushik and C.P.Kaushik

Reference : Deswal&Deswal, Raja Gopal, Dharmaraj Publishers.

MECHANICS OF SOLIDS-I

Course code	Title of the course	Contact periods for delivering the course	Credits
1995304	MECHANICS OF SOLIDS-I	L T P 3 0 0	Credits: 3

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

CO1	Understand the basic concepts of stress, strain and relations based on linear elasticity and understand the theory of elasticity and Hooke's law.
CO2	Analyse beams to determine shear force and bending moments.
CO3	Analyse Bending and shear stress distribution in different sections of beams.
CO4	Determine deflections at any point of the beams and derive the torsion equation and solve problems on torsion of mechanical components.
CO5	Identify, analyse and solve problems on thin cylinders.

Note: L – Lecture periods; T- Tutorial periods; P- Practical periods

Unit-I

SIMPLE STRESSES AND STRAIN: Stress, Strain, Stress- Strain curve, Lateral strain, Relationship between elastic constants, Bars of varying cross-section, Compound bars, Temperature stresses in bars. Complex Stresses: Stresses on an inclined plane under different uniaxial and biaxial stress conditions, Principal planes and principal stresses, Mohr's circle, Relation between elastic constants, Strain energy, Impact loading.

Unit-II

BENDING MOMENTS AND SHEAR FORCES: Beam - Types of loads, Types of supports, S.F. and B.M. diagrams for Cantilever, Simply supported and Over hanging beams.

Unit-III

STRESSES IN BEAMS: Theory of bending, Flexural formula, 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 in beams, Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T, angle sections.

Unit-IV

DEFLECTIONS OF BEAMS AND TORSIONAL STRESSES: Relation between curvature, slope and deflection, double integration method, Macaulay's method, Moment area method -application to simple cases including Cantilever, Simply supported and Over hanging beams. Analysis of torsional stresses, Power transmitted, Combined bending and torsion, Closed and open coiled helical springs.

Unit-V

CYLINDERS AND SPHERICAL SHELLS: Stresses and strains in 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 and Thin spherical shell.

Text Books:

1. Analysis of Structures, by Vazirani and Ratwani, Vol. 1, 1993 edition.
2. Mechanics of Materials by James M. Gere , Stephen P. Timoshenko , CBS Publishers
3. Solid Mechanics, by Popov

Reference:

1. Strength of Materials, by Timoshenko
2. Strength of Materials -By Jindal, Umesh Publications.
3. Analysis of structures by Vazirani and Ratwani.
4. Mechanics of Structures Vol-III, by S.B.Junnarkar.
5. Strength of Materials by Andrew Pytel and Ferdinond L. Singer Longman

BASIC THERMODYNAMICS

Course code	Title of the course	Contact periods for delivering the course	Credits
1995305	BASIC THERMODYNAMICS	L T P 3 0 0	Credits: 3

COURSE OBJECTIVES:

CO 1	To give a clear understanding of basic concepts of thermodynamics, thermodynamic system and fundamental concepts relevant to perfect gases and real gases.
CO 2	To describe the various non flow and flow engineering system with the application of first law and to understand the second law of thermodynamics
CO 3	To explain the different thermodynamic relationships and carry out the performance of various air standard cycles.

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

CO 1	Strengthen knowledge on basic concepts of thermodynamics and to identify the approach to analyze thermodynamic system, interaction with surroundings in terms of energy and recapitulate the fundamental concepts relevant to perfect gases and real gases.
CO 2	Analyze various non-flow and steady flow engineering systems with the application of first law of thermodynamics.
CO 3	Identify the possibilities to improve the performance of heat engine, refrigerator and heat pump in conformity with second law of thermodynamics and to gain insight knowledge on reversibility, irreversibility and Carnot cycle.
CO 4	Analyze the entropy of different thermodynamic systems and to study various thermodynamics potentials and different relationships among them.
CO 5	Carryout thermodynamic analysis and computation of the performance of air-standard cycles such as Otto cycle, Diesel cycle and Dual cycle along with other basic thermodynamic reversible cycles namely Stirling cycle, Erricson cycle, Atkinson cycle and Brayton cycle.

Note: L – Lecture periods; T- Tutorial periods; P- Practical periods

Unit- I:

Fundamental concepts of Thermodynamics: Basic concepts; Thermodynamic systems; Microscopic and Macroscopic approaches- Homogeneous and heterogeneous systems; Concept of continuum; Pure substance; Thermodynamic equilibrium; State; Property; Path; Process; Reversible and irreversible cycles; Work; Heat; Point function; Path function; Heat transfer, Zeroth law of thermodynamics, Concept of equality of temperatures- Perfect gas laws- Specific heat at constant pressure and constant volume and their relation-Real gases- Vanderwall's equation of state.

Unit- II:

First law of thermodynamics: Joule's experiments - First law of thermodynamics for closed system undergoing a cycle and a change of state - First law of thermodynamics for flow systems- Application of First law of thermodynamics to various non-flow processes and steady flow systems- throttling and free expansion process -Limitations of first law of thermodynamics.

Unit- III:

Second law of thermodynamics: Kelvin Plank statement and Clasius statement and their equivalence, Corollaries- Perpetual motion machines of first kind and second kind-Reversibility and irreversibility- Cause of irreversibility- Carnot cycle- Heat engines and heat pumps- Carnot efficiency- Clasius theorem- Clasius inequality.

Unit- IV:

Entropy, Availability and irreversibility: Concept of entropy-Principles of increase of entropy-Entropy and disorder-Helmholtz function and Gibbs function- Availability in steady flow- Entropy equation for flow process- Maxwell's equations- Tds relations- Heat capacities.

Unit-V:

Air standard cycles: Air standard efficiency- Thermodynamic analysis of Otto cycle, Diesel cycle, Dual cycle, Brayton cycle, Atkinson cycle, Stirling cycle, Erickson cycle

Text Book:

1. Engineering Thermodynamics, by P.K. Nag, Tata McGraw-Hill Publications Company, 5th Revised Edition
2. Applied Thermodynamics-I by R. Yadav, Central Book House.Engineering, 6th Revised Edition
3. Thermodynamics An Engineering Approach by Yunus A Cengel,Michael A.Boles, Tata McGraw-Hill Publications Company, 9th Edition.

References:

1. Engineering Thermodynamics by Rathakrishnan, Prentice - Hall India. 2nd Revised Edition of India
2. Engineering Thermodynamics Through examples by Y.V.C. Rao , Universities Press (India) Private limited
3. Thermal Engineering by R.K. Rajput, Laxmi Publications,10th Edition.
4. Fundamentals of Thermodynamics by Sonntag, Borgnakke,Van Waylen, John Wiley & Sons, 6th Edition.

MANUFACTURING PROCESSES

Course code	Title of the course	Contact periods for delivering the course	Credits
1995306	MANUFACTURING PROCESSES	L T P 3 0 0	Credits: 3

COURSE OBJECTIVES:

1. To provide an understanding and appreciation of the different manufacturing (Casting, Forming) and fabrication (Welding, Soldering and Brazing) methods to the students.
2. To expose the students to various applications of the manufacturing process in real life articles/ products.
3. To expose the students to advanced techniques for a day to day application in manufacturing industry.

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

CO1	Discuss and analyze the process of casting and terminology associated with sand casting.
CO2	Classify several special casting processes and identify various casting defects
CO3	Illustrate and select the type of forming technique to be used for manufacturing the components.
CO4	Identify different bulk deformation techniques and sheet metal operations with their applications.
CO5	Assess the weld methodology to be followed for attaining better weld quality using various welding techniques.

Note: L – Lecture periods; T- Tutorial periods; P- Practical periods

Unit I

Casting : Job, Batch and Mass production; Primary and Secondary Manufacturing Processes; Terminology; Pattern Types, Materials and Allowances; Sand composition, types, properties, preparation and Testing of moulding sands; Moulding tools and equipment; Sand moulds preparation (Manual, Moulding machines and CO_2 Moulding), types of sand moulds; Core- types and making, Core Prints, chaplets, chills; Elements of gating system- Sprue; Runner, gates and risers types; Gating system design, Melting and pouring of the metal, types of furnaces(Cupola ,Induction), fluidity.

Unit II

Special Casting Processes:

Expendable mould casting processes – Shell mould casting, investment casting.

Permanent mould casting processes- High and Low Pressure die casting, Centrifugal casting, Continuous casting, squeeze casting; Stir Casting, Casting Defects.

Unit III

Rolling: Cold and hot working; Rolling- Types of Rolling mills, Roll size, Roll Pressure distribution, Rolling Defects;

Forging: Forging processes; Forging techniques; Forging presses; Forging pressure distribution and forging force; Automation of forging;

Unit IV

Special Bulk Deformation Processes:

Extrusion- Forward, Backward, Impact and Hydrostatic Extrusion, Wire, Bar and Tube Drawing; Swaging.

Sheet metal working:

Press Tool operations; Deep drawing, metal spinning, Stretch forming, embossing and coining, sheet metal Dies and Punches- types and applications, Peening.

Unit V

Welding: Welding metallurgy; Principles and processes of arc welding (SMAW, GTAW, GMAW, FCAW, PAW, SAW); Welding equipment – classification of welding power source and characteristics; Weld positioners and fixtures; Oxyacetylene welding; Flame cutting; Brazing and soldering; Principle of resistance welding; Types of resistance welds; Seam welding; Projection welding; Resistance butt welding; Solid state welding; Weld defects, inspection and testing.

Text Book:

1. Manufacturing Technology-Foundry, Forming and Welding by P.N. Rao, 5th Edition, Vol-1, Tata McGraw Hill Publishing Company.
2. Manufacturing Science by Amitabha Ghosh and Ashok Kumar Mallik, 2nd Edition, East-West Press Pvt Ltd.
3. Welding Processes and Technology by R. S. Parmar, 3rd Edition, Khanna Publishers.

Reference Books:

1. Process and Materials of Manufacture by Roy A. Lindberg, 4th Edition, Prentice-Hall of India Private Limited.
2. Manufacturing Engineering & Technology by Kalpak Jian, 7th Edition Addition Wesley, Pearson.
3. Materials and Processes in Manufacturing by De Margo, Black and Kohser, 11th edition, Wiley, Prentice Hall of India.
4. Principles of Metal Casting by Richard W. Heine, Carl R. Loper, Philip C. Rosenthal, 2nd Edition,Tata Mc-Graw Hill India.

UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY

Course code: **1995307** Curricular Structure Semester	L	T	P	C	**Credits: 2-1-0-3** Course No. & Title
3 or 4	2	1	0	3	H-102

Pre-requisites: None. Universal Human Values 1 (desirable)

1. OBJECTIVE:
The objective of the course is four fold:
1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

OUTCOME OF THE COURSE:

By the end of the course, students are expected
CO1: to become more aware of themselves, and their surroundings (family, society, nature); CO2: they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
CO3: They would have better critical ability.
CO4: They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
CO5: It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

2. COURSE TOPICS:

The course has 28 lectures and 14 practice sessions in 5 modules:

Module 1:
Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario

6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

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

Module 2:
Understanding Harmony in the Human Being - Harmony in Myself!

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

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

Module 3:
Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

1. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
2. Understanding the meaning of Trust; Difference between intention and competence
3. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
4. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
5. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

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

Module 4:

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

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

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

Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

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

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

3. READINGS:

3.1 Text Book

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

3.2 Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad

12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

To decide the necessity

Universal Human Values 2: Understanding Harmony

Human Values Courses

This course also discusses their role in their family. It, very briefly, touches issues related to their role in the society and the nature, which needs to be discussed at length in one more semester for which the foundation course named as "H-102 Universal Human Values 2: Understanding Harmony"is designed which may be covered in their III or IV semester.

During the Induction Program, students would get an initial exposure to human values through Universal Human Values – I. This exposure is to be augmented by this compulsory full semester foundation course.

4. MODE OF CONDUCT (L-T-P-C 2-1-0-3 or 2L:1T:0P 3 credits)

Lectures hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.

Tutorial hours are to be used for practice sessions.

While analysing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student
to connect with one's own self and do self-observation, self-reflection and self-exploration.

Scenarios may be used to initiate discussion. The student is encouraged to take up" ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and
discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory
is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses.

This course is to be taught by faculty from every teaching department, including HSS faculty. Teacher preparation with a minimum exposure to at least one 8-day FDP on Universal Human Values is deemed essential.

5. ASSESSMENT:

This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation.

Example:

Assessment by faculty mentor: 10
marks Self-assessment: 10 marks
Assessment by peers: 10 marks
Socially relevant project/Group Activities/Assignments: 20
marks Semester End Examination: 50 marks

The overall pass percentage is 40%. In case the student fails, he/she must repeat the course. This is only an introductory foundational input. It would be desirable to follow it up by

a) faculty-student or mentor-mentee programs throughout their time with the institution

b) Higher level courses on human values in every aspect of living. E.g. as a professional

FUELS & MECHANICS LAB

Course code	Title of the course	Contact periods for delivering the course	Credits
1995302P	FUELS & MECHANICS LAB	L T P 0 0 3	Credits: 1.5

Course Outcomes: At the end of the laboratory course, the student will be able to:

CO 1	Compare the flash, fire points and carbon residue of different fuels.
CO 2	Find the absolute and kinematic viscosity of different fuels.
CO 3	Calibrate a given pressure guage, determine moment of inertia of a given flywheel and determine the modulus of rigidity of a given wire using a torsion pendulum.
CO 4	Verify law of polygon of forces and principle of moments using bell crank lever apparatus and also evaluate the coefficient of friction between two surfaces.

List of Experiments

1. Determination of the kinematic and absolute viscosity of the given sample oil using Redwood viscometer I.
2. Determination of the kinematic and absolute viscosity of the given sample oil using Redwood viscometer II.
3. Determination of flash point using Abels flash point apparatus.
4. a) Determination of flash and fire points using Cleveland open cup tester.
   b) Conradsons carbon residue test.
5. Calibration of the given pressure gauge.
6. Determination of moment of inertia of the given flywheel.
7. Determination of modulus of rigidity of the given wire with torsion pendulum.
8. Verification of polygon law of forces.
9. Verification of principle of moments using the bell crank lever apparatus.
10. Determination of co efficient of friction between two surfaces.
11. Determination of calorific value of given sample of fuel by Bomb calorimeter. (Demonstration only)

MECHANICS OF SOLIDS LAB

Course code	Title of the course	Contact periods for delivering the course	Credits
1995304P	MECHANICS OF SOLIDS LAB	L T P 0 0 3	Credits: 1.5

Course Outcomes: At the end of the laboratory course, the student will be able to:

CO 1	Understand and find the deflections due to loading and measure the loads.
CO 2	Understand the material properties of different materials and use equipment to find them.
CO3	Test for the bulking property and fineness of sand.

List of Experiments

1. Load deflection test on simply supported beam 2. Load deflection test on cantilever beam
3. To study the stress strain characteristics (tension and compression) of metals by using UTM.
4. Determination of compression strength of wood
5. Determination of hardness using different hardness testing machines (Brinell and Rockwell)
6. Impact test by using Izod and Charpy methods.
7. Deflection test on beams using UTM.
8. To find stiffness modulus of rigidity by conducting compression tests on springs. 9.To find stiffness modulus of rigidity by conducting tension tests on springs
10. Torsion tests on circular shafts.
11. Bulking of sand.
12. Sieve Analysis and determination of fineness number.

MECHANICS OF SOLIDS-II

Course code	Title of the course	Contact periods for delivering the course	Credits
1995401	MECHANICS OF SOLIDS-II	L T P 3 0 0	Credits: 3

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

CO1	Evaluate an already existing fixed and continuous beam with uniform Moment of inertia as well as Non uniform Moment of inertia which is under different loading conditions and with different support conditions and will be able to design a fixed and continuous engineering beam for any loading conditions.
CO2	Evaluate any engineering column or strut under different end conditions and under different specified variable loading conditions .
CO3	Illustrate curved beams of different cross sections and can evaluate the stresses across the cross-sections of the curved beam.
CO4	Demonstrate and compute the radial stress and circumferential stress for rotating circular disc(both hollow and solid) of uniform thickness.
CO5	Solve the radial and circumferential stress for both thick and compound cylinders under different pressurized conditions.

Note: L – Lecture periods; T- Tutorial periods; P- Practical periods

Unit-I

FIXED BEAMS AND CONTINUOUS BEAMS: Fixing moments for a fixed beam of uniform and variable sections, Effect of sinking support, slope and deflection.

Analysis of continuous beam, Reactions at the supports, Effect of sinking of supports.

Unit-II

COLUMNS AND STRUTS: Columns with one end free and the other fixed, both ends fixed, One end fixed and other hinged, Limitation of Euler's formula, Column with initial curvature, Column carrying eccentric load, Laterally loaded columns with Central point load and Uniformly distributed load, Empirical formulae.

Unit-III

BENDING OF CURVED BARS: Stresses in bars of circular, rectangular and trapezoidal sections.

Unit-IV

STRESSES DUE TO ROTATION: Wheel rim, disc of uniform thickness, disc of uniform strength.

Unit-V

THICK CYLINDERS: Subjected to internal and external pressure and compound cylinders.

Text Books

1. Analysis of Structures, Vol. 1, 1993 edition, by Vazirani and Ratwani.
2. Chapter VI from Advanced Topics in Strength of Materials, by Prof. L.B.Shah and Dr.R.T.Shah.

References

1. Strength of Materials, by Timoshenko.

THEORY OF MACHINES-1

Course code	Title of the course	Contact periods for delivering the course	Credits
1995402	THEORY OF MACHINES-1	L T P 3 0 0	Credits: 3

COURSE OBJECTIVES:

CO 1	To know about the basics of Machine and mechanism, Degree of Freedom, Kinematics Pair and inversion.
CO 2	To know velocity, Acceleration polygons, instantaneous center method.
CO 3	To know lower pair mechanism and understand the Steering gear mechanism, principles of friction
CO 4	To understand the governors
CO 5	To understand the Dynamic Force Analysis

COURSE OUTCOMES:

CO 1	Understand the knowledge of machine and mechanism and able to perform the geometric analysis for various mechanisms.
CO 2	Analyze velocity and acceleration of various mechanisms.
CO 3	Demonstrate straight line motion mechanism, Automobile Steering gear mechanism and Hooke's joint, about principles of friction
CO 4	Illustrate the principles of governors and sensitiveness of a governor
CO 5	Outline the static and dynamic strength parameters for a material and design a dynamically equivalent system.

Unit I

Mechanisms and Machines: Introduction; Mechanism and machine; Rigid and resistant bodies; Link; Kinematic pair; Degrees of freedom; Classification of kinematic pairs; Kinematic chain; Linkage, mechanism and structure; Mobility of mechanisms; The four-bar chain; Mechanical advantage; Transmission angle; The slider-crank chain; Double slider-crank chain; Miscellaneous mechanisms. **[CO1]**

Unit II

Velocity and Acceleration Analysis: Introduction; Absolute and relative motions; Vectors; Additional and subtraction of vectors; Motion of a link; Four-link mechanism; Angular velocity of links; Velocity of rubbing; Instantaneous center (I-center), Kennedy's theorem; Locating of I-centers; Velocity images; Velocity and acceleration of Slider-crank mechanism, Corriolis component of acceleration, Velocity and acceleration of Crank and slotted lever mechanism; Alzebric Methods; Klein's Construction. **[CO2]**

Unit III

Lower Pairs: Introduction; Pantograph; Straight line mechanisms; Engine indicators; Automobile steering gears; Types of steering gears; Hooke's joint; Double Hooke's joint.

Friction: Introduction; Screw threads; Wedge; Pivots and collars; Friction clutches; Antifriction bearings; friction at a journal; Mitchell thrust bearing. **[CO3]**

Unit IV

Governors: Introduction; Types of governors; Watt governor (simple conical governor); Portor governor; Proell governor; Hartnell governor; Hartung governor; Wilson-Hartnell governor (radial-spring governor); Pickering governor; Spring-controlled gravity governor; Inertia governor; Sensitiveness of a governor; Hunting; Isochronism; Stability; Effort of a governor; Power of a governor; Controlling force.

[CO4]

Unit V

Dynamic Force Analysis: Introduction; D'Alembert's principle; Equivalent offset inertia force; Dynamic analysis of four-link mechanism; Dynamic analysis of slider-crank mechanism; Engine force analysis; Dynamically equivalent system; Inertia of the connecting rod; Fluctuations of energy; Flywheels. **[CO5]**

Text Book:

1. Theory of Machines by R.S.Khurmi & J.K.Gupta

Reference books:

1. Theory of Machines by Thomas Bevan.
2. Theory of Machines by S.S. Rattan.
3. Theory of Machines by THOMAS BEVAN, PEARSON INDIA.
4. Theory of Machines and Mechanisms by Gordon R. Pennock, Joseph E. Shigley, John J. Uicker. Jr.
5. Theory of Machines & Mechanisms by Ballaney P. L.

METAL CUTTING AND MACHINE

Course code	Title of the course	Contact periods for delivering the course	Credits
1995403	METAL CUTTING AND MACHINE TOOLS	L T P 3 0 0	Credits: 3

COURSE OBJECTIVES:

1. To give a clear understanding of the mechanism of machining to the students
2. To describe the mechanisms of the various metal cutting machines, types of machines, various operations that can be performed on them, machining time and force calculations etc to the students.
3. To expertise in advance numerical control machines to maximise the work output and efficiency of the numerical machines.

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

CO1	Know the mechanism of metal cutting and calculate the machining times and forces developed during machining
CO2	Understand the principle of working of a lathes, capstan and turret lathes and automatic lathes along with all the accessories.
CO3	Know the working and principle of milling, drilling and boring machines and illustrate different operations performed on them using various tools.
CO4	Identify different types of operations, specifications and principles of shaping, slotting, planing machines, finishing operations on grinders, lapping and honing.
CO5	Know the importance, use, applications, advantages and limitations of various computer numerical control machines and part programming

Note: L – Lecture periods; T- Tutorial periods; P- Practical periods

Unit I

Mechanics of Metal Cutting; Chip formation & Types; Tool geometry and tool signature ASA&ISO systems; Orthogonal and Oblique Cutting, Tool materials; Cutting fluid, Merchant Circle analysis, Tool wear and tool life; Cutting forces and power:-simple problems

Unit II

Lathe Machines: Engine lathe – principle of working, specification of lathe – types of lathe – work holders tool holders – box tools taper turning, thread turning – for lathes and attachments, constructional features of speed gear box and feed gear box. Turret and capstan lathes – collet chucks – other work holders – tool holding devices – box and tool layout. Principal features of automatic lathes – classification – single spindle and multi-spindle automatic lathes – tool layout and cam design for automats.

Unit III

Drilling & Boring machines: Principles of working, specifications, types, operations performed – tool holding devices – twist drill – deep hole Drilling Machine.
Boring Machines – fine Boring Machines – jig boring machine & Broaching operations.
Milling Machines: Principles of working – specifications – classification of Milling Machines – Principle features of horizontal, vertical and universal Milling Machine, machining operations, types of cutters, geometry of milling cutters – methods of indexing, accessories of milling machines.

Unit IV

Shaping, Slotting and Planing Machines: Principles of working – principal parts – specifications, operations performed, machining time calculations.
Finishing Processes: Theory of grinding – classification of grinding machines, cylindrical and surface grinding machines, tool and cutter grinding machines, different types of abrasives, bonds, specification and selection of a grinding wheel. Lapping, Honing.

Unit V

Computer-Numerical Control Machines: Numerical control- NC operation, Coordinate system; CNC Machines- classification (Machining centre and Turning centre) constructional features, CNC controller, Designation of co-ordinate axes for CNC machines, types of motion controls in CNC machines, applications of CNC machines; DNC- system, advantages of DNC over NC and CNC

Part Programming: Designation of co-ordinate axes for CNC machines, Functions of machine control units, Tape format, Manual part programming and computer assisted part programming (using APT language). Exercises involving simple contours and positioning.

Text Book:

1. Process and Materials of Manufacture (4th Edition) by Roy A. Lindberg, Prentice-Hall of India Private Limited.
2. Manufacturing technology II, P.N Rao. TMH Ltd 1998(Revised edition).
3. CAD/CAM- Computer Aided Design & Manufacturing, by M.D.Groover & E.W.Zimmer.

Reference Books:

1. Metal Cutting Principles by M.C. Shaw, MIT Press, Cambridge.
2. Metal Cutting-Theory and Practice by Amitabha Bhattacharya, Central Book Publishers.
3. Production Engineering by P.C. Sharma, S. Chand and Company.
4. Production Technology by H.M.T. (Hindustan Machine Tools).
5. Production Engineering, K.C Jain & A.K Chitaley, PHI Publishers
6. Technology of machine tools, S.F.Krar, A.R. Gill, Peter SMID, TMH (I).

FLUID MECHANICS

Course code	Title of the course	Contact periods for delivering the course	Credits
1995404	FLUID MECHANICS	L T P 3 0 0	Credits: 3

COURSE OBJECTIVES:

CO 1	To give fundamental knowledge of fluid properties,its behaviour and understand the principles of hydrostatic law, buoyancy and floatation.
CO 2	To imbibe the application of basic laws and equations used for analyzing the static and dynamic fluids.
CO 3	To give the importance of compressible fluid and the use of stagnation properties in determining the flow of fluid.

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

CO 1	Identify fluid properties, approach for pressure measurement using manometers and understand the principle of buoyancy and floating bodies.
CO 2	Illustrate the principles of continuity, momentum and energy equation and analyze various fluid problems with the application of Bernoulli's principle.
CO 3	Identify flow in pipe and analyze the friction in a pipe with an application of friction factor.
CO 4	Apply the boundary layer theory to solve displacement ,energy and momentum thicknesses.
CO 5	Make use of Mach number, identify an approach to solve flow through nozzles by analyzing the stagnation properties .

Note: L – Lecture periods; T- Tutorial periods; P- Practical periods

Unit-I:

Fluid Statics: Introduction-Fundamentals of fluid properties- Pressure and its measurement ,Absolute, Gauge, Atmospheric and Vacuum pressure – Manometers, Simple manometers, Differential manometers. Hydrostatic forces on surfaces - Total Pressure and Centre of Pressure - Vertical, Horizontal, Inclined and Curved plane surfaces submerged in liquid- Buoyancy and Floatation.

Unit- II:

Fluid Kinematics & Fluid Dynamics: Types of fluid flow - Continuity equation - Velocity potential function and Stream Function - Types of Motion, Linear Translation, Linear deformation, Angular deformation, Rotation, Vorticity and circulation-Vortex flow, forced and Free Vortex – Equation of Motion- Euler's equation - Bernoulli's equation and its applications- Venturimeter, Orifice Meter, Pitot tube-Momentum Equation-Momentum of momentum Equation- Free Liquid Jet.

Unit- III:

Viscous Flow : Couette flow- Plane Couette flow, Favourable pressure gradient and adverse pressure gradient-Power absorbed in Viscous Flow- Flow through pipes- Hagen Poiseulle flow-Fannigs friction factor- Darcy's Weisbach friction factor- Loss of head due to friction in pipes, Minor Losses and Major losses - Flow through branched pipes- Power transmission through pipes-Two dimensional viscous flow: Navier -Stokes equations and solutions (Elementary Treatment)

Unit- IV:

Boundary layer theory: Definition- Laminar Boundary Layer-Laminar Sub layer- Boundary Layer thickness-Displacement thickness, Momentum thickness and Energy thickness-Momentum integral equation- Flow over a flat plate.

Laminar- Turbulent transition- Momentum equations and Reynold's stresses- Fully developed turbulent flow through a pipe- Turbulent boundary layer on a flat plate- Laminar sub-layer-Boundary layer separation and control.

Unit-V:

Compressible fluid flow: Thermodynamic relations- Continuity, Momentum and Energy equations- Velocity of sound in a compressible fluid- Mach number and its significance- Limits of incompressibility- Pressure field due to a moving source of disturbance- Propagation of pressure waves in a compressible fluids- Stagnation properties- Stagnation pressure, Temperature and density- Area velocity relationship for compressible flow- Flow of compressible fluid through nozzles- Condition for maximum discharge through nozzles- Variation of mass flow with pressure ratio- Compressible flow through a venturimeter- Pitot static tube in a compressible flow.

Text Book:

1. Fluid Mechanics and Hydraulic Machines, by R. K. Bansal, Laxmi publications.
2. Fluid Mechanics, by A.K. Mohanty, Prentice Hall of India Pvt.Ltd.

References:

1. Hydraulics and Fluid Mechanics including Hydraulics machines by PN Modi & SM Seth, Standard Book House Publisher,22nd Edition (2019)
2. Foundations of Fluid Mechanics, by Yuan, Prentice Hall of India.
3. Fluid Mechanics and its Applications, by S. K.Gupta and A.K.Gupta, Tata McGraw Hill, New Delhi.
4. Fluid Mechanics by Frank M.White, Tata McGraw Hill, 8th Edition (2016)
5. Fluid Mechanics and Hydraulic Machines by R. K. Rajput, S.Chand & Co.
6. Fluid Mechanics by Kothandaraman and Rudramoorthy.

Metallurgy and Material Science

Course code	Title of the course	Contact periods for delivering the course	Credits
1995405	Metallurgy and Material Science	L T P 2 0 0	2

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

1. Identify crystal structures and characterize them
2. Categorise types of binary phase diagrams and iron-iron carbide phase diagram and other binary phase diagrams can be notated and characterized.
3. Understand different heat treatment regimes in steels and their transformations, various surface heat treating and precipitation hardening techniques can be identified and analysed.
4. Identify Iron alloys and cast iron alloys depending on the various alloying elements
5. Classify non ferrous alloys and identify methods for manufacturing P/M products and their applications.

Unit I

Structure of crystalline solids: Atomic structure & bonding in solids- Crystal structures- calculations of radius, Crystallography: Classification of Crystal lattices-Miller Indices Coordination Number and Atomic Packing Factor for different cubic structures - Imperfection in solids, point defects, linear defects, planar defects and volume defects- Concept of Slip & twinning.

Unit II

Phase diagrams: Basic terms- phase rule- Lever rule & free energy of phase mixtures cooling curves- Phase diagram & phase transformation - construction of phase diagrams, binary phase diagrams - Brass, Bronze, Al-Cu and Al-Si phase diagrams- Invariant reactions, eutectic, peritectic, eutectoid, peritectoid, monotectic reactions, Iron carbon phase diagram & microstructures of plain carbon steel & cast iron

Unit III

Heat treatment: Heat treatment of steel- Annealing, and its types, normalizing, hardening, tempering, martemering, austempering - TTT diagrams, drawing of TTT diagram, TTT diagram for hypo-& hypereutectoid steels, effect of alloying elements, CCT diagram- Martensitic transformation, nature of martensitic transformation- Surface hardening processes like case hardening, carburizing, cyaniding, nitriding, induction hardening, hardenabilty, Jominy end-quench test, Age hardening of Al & Cu alloys, Precipitation Hardening

Unit IV

Engineering Alloys: Properties, composition, microstructure and uses of low carbon, mild medium & high carbon steels. stainless steels, high speed steels, Hadfield steels, tool steels - Cast irons, gray CI, white CI, malleable CI, SG cast iron

Unit V

The light alloys- Al & Mg & Titanium alloys; Copper & its alloys- brasses & bronzes; super alloys. Powder Metallurgy: Powder Metallurgy process, Preparation of powders, Characteristics of Metal powders, mixing, compacting, sintering, Applications of Powder Metallurgy.

Text Books:

1. Introduction to Physical Metallurgy by Sidney H Avner, 2nd Edition, Tata McGraw-Hill, 1997
2. "Materials Science & Engineering- An Introduction", William D.Callister Jr., David G Rethwisch, Wiley India Pvt. Ltd., 9th Edition, 2014, New Delhi.

References

1. Physical Metallurgy, Principles & Practices, V Raghavan, PHI 3rd Edition 2016, New Delhi.
2. Materials Science and Engineering: A First Course , V. Raghavan, PHI 5th Edition 2011, New Delhi.

Electrical & Electronics Engineering

Course code	Title of the course	Contact periods for delivering the course	Credits
1995406	Electrical & Electronics Engineering	L T P 3 0 0	Credits: 3

Course Outcomes

CO1: Explain the basic concepts of magnetic circuits and electric circuits.
CO2: Understand the fundamental concepts of DC generators and motors.
CO3: Understand and analyze the fundamentals of AC Machines (transformers, 3-phase induction motor, Synchronous machine).
CO4: Explain and analyze the operation of semiconductor devices.
CO5: Analyze the logic gates, Flip flops, Registers, Counters & microprocessors.

Unit I

MAGNETIC CIRCUITS & A.C. CIRCUITS: Definitions of magnetic circuit, Reluctance, Magnetomotive force (m.m.f), Magnetic flux, Simple problems on magnetic circuits, Hysteresis loss. Introduction of steady state analysis of A.C. circuits, Single and balanced 3- phase circuits.

Unit II

D.C. MACHINES: D.C. generator principle, Construction of D.C. generator, E.M.F. equation of D.C. generator, Types of D.C. generators, Characteristics of D.C. generators, Applications of D.C. generator. D.C. motor principle, Working of D.C. motors, Significance of back E.M.F., Torque equation of D.C. motors, Types of D.C. motors, Characteristics of D.C. motors, Speed control methods of D.C. motors, Applications of D.C. motor, Swinburne's test.

Unit III

A.C MACHINES: Transformer principle, E.M.F. equation of transformer, Transformer on load, Equivalent circuit of transformer, Voltage regulation of transformer, Losses in a transformer, Calculation of efficiency and regulation by open circuit and short circuit tests.
Induction motor working principle, Construction of 3-phase induction motor, Torque equation of induction motor, Slip-torque characteristics, Torque under running condition, Maximum torque equation.

Alternator working principle, E.M.F. equation of alternator, Voltage regulation by sync, impedance method. Synchronous motor principle of operation, Methods of starting of synchronous motor.

Unit IV

SEMICONDUCTOR DEVICES: Semi-conductor P-N diode, Zener diode - Transistor - Silicon control rectifier. Rectifiers, Amplifiers, Oscillators, Cathode ray oscilloscope.

Unit V

INTRODUCTION TO DIGITAL ELECTRONICS & MICROPROCESSORS: Fundamentals of digital electronics, Number system and codes, Logic gates, Boolean algebra, Arithmetic-logic units, Flip-flops, Flip-flop conversions, Registers and counters. Intel-8085 microprocessor, Architecture, Instruction set, Execution of instructions, Addressing structures, Programming.

Text Book:

1. Principles of Electrical Engineering and Electronics by V.K. Mehta, S. Chand & Co.
2. Electrical Technology volume-I,II by B. L.THEREJA
3. Microprocessor Architecture, programming and applications with 8085 by Ramesh Gaonkar penram publications 5th Edition.

Reference:

1. A First Course in Electrical Engineering by D.P Kothari.
2. Electrical Machines by J.B Gupta.

MANUFACTURING TECHNOLOGY LAB – I

Course code	Title of the course	Contact periods for delivering the course	Credits
1995403P	**MANUFACTURING TECHNOLOGY LAB – I**	**L T P** **0 0 3**	**Credits: 1.5**

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

CO1	Design moulds of simple objects using single and split piece patterns and use various accessories such as cope, drag, riser, lifter etc., to create moulds.
CO2	Join metal plates to create butt joint, Lap Joint, T fillet, and select appropriate parameters for improvement of weld quality.
CO3	Machine the metals using turning, shaping and milling tools

Note: L – Lecture periods; T- Tutorial periods; P- Practical periods

LIST OF EXPERIMENTS

1. Step Turning on a Lathe
2. Taper Turning on a Lathe
3. Threading and Knurling Operations on A Lathe
4. Hexagonal Block on a Shaper
5. Spur Gear on a Milling
6. Preparation of Mould Cavity by Using a Single Piece Pattern
7. Preparation of Mould Cavity by Using a Split Piece Pattern
8. Square Butt Joint
9. Lap Joint
10. Tee Fillet Joint

Mechanical Engineering Drawing

Course code	Title of the course	Contact periods for delivering the course	Credits
1995407	**Mechanical Engineering Drawing**	**L T P** **0 0 3**	**Credits: 1.5**

COURSE OBJECTIVES:

1. To provide an understanding and draw the assembly drawing of various engine components and machine tool components to the students.
2. To expose the students to draw and place feature control symbols and datum references on a drawing various fastenings (Screw, Riveted, welded etc.), Bearings, couplings, key etc.
3. Students will be able to understand and demonstrate the basics of Geometric Dimensioning and Tolerancing (GD&T) Preparation of process sheets, stock strip layouts in sheet metal work. and machine elements and their assembly drawings.
4. Students will be able to understand and prepare the process sheets, stock strip layouts.

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

CO1	Understand and draw the orthographic views and sectional views of machine tool parts and draw various thread profiles and Screwed fasteners.
CO2	Draw various temporary and permanent fasteners such as keys, cotter joints, pin joints and riveted joints.
CO3	Draw various couplings and bearings
CO4	Draw Assembly drawings of various engine components and other machine parts.
CO5	Draw the production drawings indicating limits, geometrical tolerances, surface roughness and prepare process and also sheets stock strip layouts.

Note: L – Lecture periods; T- Tutorial periods; P- Practical periods

Unit-I

Introduction to machine drawing, Orthogonal Projection: B.I.S. code, symbols for methods of projection. Sectional views of machine parts: Half sectional View and Full Sectional View,

Screw Threads and Fastenings: Screw Threads: Forms of screw threads, Metric Thread, With worth Thread, B.S. F., Sellers Thread, B.A., Square Threads. Screw Fasteners: Types of nuts and bolts, Foundation bolts using standard Empirical formulae

Unit-II

Keys and Joints: Key Joints- Taper Keys and Parallel keys; Riveted joints- Forms of riveted heads, Lap Joint and Butt Joint; Cotter joints- Socket and spigot joint, Sleeve joint, Strap Joint, Pin-joints.

Unit-III

Couplings and Bearings: Couplings- Box and split muff couplings, Flanged couplings, Flexible couplings, Universal and Oldham couplings.
Shaft Bearings: Solid Bearing, Bushed bearing, Plummer block, Foot-step bearing.

Unit-IV

Assembly Drawing:
a) Engine parts- Stuffing box, Cross head, Eccentric, Petrol Engine connecting rod
b) Other machine parts- Screws jack, Tailstock

Unit-V

Production drawing: Conventional Representation, Limits, Fits, Geometric Tolerances, Surface roughness, Preparation of process sheets, stock strip layouts in sheet metal work.

Text Book:

1. Machine Drawing by N D Bhatt, 44th Edition, Charotar publishers,2009.
2. Production Drawing by K.L.Narayana, P.Kannaiah and K.VenkataReddy, New age international Publishers

Reference Books:

1. Textbook of Machine Drawing by K.C. John, PHI Learning
2. Machine Drawing by K.L Narayana, P. Kannaiah and K. Venkata Reddy, New age international Publishers
3. A Text Book of Machine Drawing by Dr. R.K. Dhawan, S.Chand PublicationsProduction Engineering by P.C. Sharma, S. Chand and Company.

Electrical & Electronics Engineering lab

Course code	Title of the course	Contact periods for delivering the course	Credits
1995406P	**Electrical & Electronics Engineering lab**	**L T P** **0 0 3**	**Credits: 1.5**

COURSE OUTCOMES

By the end of course a student would be able to

1. Verify Ohm's law and Kirchhoff's law, superposition theorem for a given resistive network excited by a D.C. source.
2. Determine Regulation of a single phase transformer, Alternator, and efficiency of a Three-Phase Induction motor, D.C Shunt motor.
3. Explain the behaviour of PN junction diode & zener diode with their volt ampere characteristics.
4. Understand the operation of CRO & Verification of truth tables of logic gates & flip-flops practically.
5. Explain & analyse the addition & subtraction of two 8 bit numbers in 8085 microprocessors.

LIST OF EXPERIMENTS

1. Verification of Ohm's law & Kirchhoff's law
2. Verification of Superposition Theorem
3. Open circuit test and short circuit test on 1-phase transformer
4. No load and blocked rotor tests on 3-phase squirrel cage Induction motor
5. Regulation of alternator by synchronous Impedance method
6. Brake test on a D.C Shunt motor.
7. V-I Characteristics of P-N Junction diode & zener diode
8. Full Wave Rectifier with filter
9. Study of Cathode Ray Oscilloscope (CRO).
10. Verification of Logic Gates.
11. Verification of flip-flops.
12. Write a program on addition and subtraction of two 8 bit numbers of 8085 microprocessors.