



## SGGS INSTITUTE OF ENGINEERING & TECHNOLOGY, NANDED

(An Autonomous Institute of Government of Maharashtra)

**S.Y. B. Tech. (Mechanical) Curriculum Structure**

**Academic year 2015-16 onwards**

Semester III							
Course Code	Course Title	Lectures (L)	Tutorials (T)	Practical (P)	Credits		
					Th.	Pr.	
ME201	Strength of Materials	03	01	02	04	01	
ME202	Applied Thermodynamics	03	01	02	04	01	
ME203	Mechanical Measurements and Metrology	03	01	02	04	01	
ME204	Engineering Metallurgy	03	--	02	03	01	
ME205	Manufacturing Processes – I	03	--	02	03	01	
HS222	Human Values and Professional Ethics	02	--	--	02	--	
<b>Total</b>		<b>17</b>	<b>03</b>	<b>10</b>	<b>20</b>	<b>05</b>	
					<b>Total Credits</b>		<b>25</b>
Semester IV							
Course Code	Course Title	Lectures (L)	Tutorials (T)	Practical (P)	Credits		
					Th.	Pr.	
MA203	Mathematics-III	04	--	--	04	--	
ME206	Theory of Machines	03	--	02	03	01	
ME207	Fluid Mechanics & Hydraulic Machines	03	01	02	04	01	
ME208	Manufacturing Processes – II	03	--	02	03	01	
ME209	Machine Drawing and Computer Aided Drafting	02	--	02	02	01	
ME210	Computer Programming	--	--	02	--	01	
HS221	Professional Communication	02	--	02	02	01	
<b>Total</b>		<b>17</b>	<b>01</b>	<b>12</b>	<b>18</b>	<b>06</b>	
					<b>Total Credits</b>		<b>24</b>
					<b>Total</b>		<b>49</b>

**ME201 – STRENGTH OF MATERIALS**  
(CREDITS THEORY:04, PRACTICAL: 01)

**Course code:** ME201

**Contact Hours/Week:** Th.03, Tu 01, Pr.02

**Course Objective:**

- To provide the basic concepts and principles of strength of materials.
- To give an ability to calculate stresses and deformations of objects under external loadings.
- To impart the techniques to determine stress and strain at any point in a member.
- To give an ability to apply the knowledge of strength of materials to engineering applications and design problems.

**Course Outcomes:** student will be able to;

- Predict the deformation , behavior, failure of deformable bodies under external loading.
- Model real-world problems using engineering Strength of Materials.
- Shows ability to determine stress and strain at any point in a member.
- Shows ability to calculate various type of stresses strains in beams, shafts, cylinders, columns etc.
- Will show the basic knowledge required for design of machine/structural component.

**Evaluation Scheme:**

Theory	Practical
Mid Term : 30 Marks	Continuous Evaluation : 50%
End Term : 70Marks	Practical Examination : 50%

**Course Content:**

**Simple Stress and Strain:** Concept of stress and strain (linear, lateral, shear & volumetric), Hookes Law, Elastic constants & their relationship, Stresses of varying section in step, circular and rectangular. Temperature stresses.

**Principal Stresses and Strains:** Normal & shear stress on any oblique plane & concept of principal plane, principal planes by analytical methods & graphical method.

**Strain Energy:** Strain energy due to axial loads, impact loads.

**Bending Stresses:** Theory of simple bending, Concept and assumptions, Derivation of flexure formula, Bending stresses distribution diagram, Different IS steel section, Flitched beams, Design of a section.

**Shear Stress in Beams:** Concept and derivation of shear stress distribution formula, Shear stress distribution diagram for symmetrical and unsymmetrical section.

**Combined direct and bending stresses:** Introduction, stress distribution for an eccentric loaded rectangular section, the middle third rule, core or kernel section, circular solid and hollow section, structural section.

**Torsion of Circular Shaft:** Theory of torsion of shaft of circular cross section, Assumptions, Derivation of torsion formulae, Stress in shaft of hollow, solid, composite circular cross section

subjected to twisting moments, Stresses due to combined torsion, bending and axial force on shaft, Flanged coupling.

**Thin & Thick Pressure Vessels:** Thin pressure vessels: Stress, Strain and deformation in thin walled seamless cylindrical and spherical vessels. Thick pressure vessels: Lamé's theory, Stresses in thick cylindrical shell and compound cylinder, Initial difference of radii at the junction of compound tube, Stresses in thick spherical shell.

**Deflection of Beams:** Concept of deflection, Slope and deflection by double integration method (Macaulay's method). Slope and deflection for simply supported, cantilever and statically determinate beam.

**Axially Loaded Columns :-** Concept of critical load and buckling, Derivation of Euler's formula for buckling load with various end conditions, limitations of Euler's formula, Rankine buckling load, Safe load on column.

**Term Work:**

**List of Experiments:-**

The term work shall consist of following lab test on mechanical properties of material

1. Tension test on M.S. and TOR bar (ductile and brittle material).
2. Bending test.
3. Shear test.
4. Torsion test.
5. Hardness test.
6. Impact test.

**Practical Examination:**

End Term Practical Examination shall be a practical /oral examination based on above syllabus.

**Reference Books:**

1. Timoshenko and Young, "Strength of Material", East West Press, 2011.
2. R. K. Rajput " Strength of Materials" S.Chand & Company (Ltd) New Delhi
3. A. R. Basu, "Strength of materials", Dhanapatrai & company, New Delhi.
4. I. B. Prasad, " Engineering Mechanics and Strength of Materials", Khanna Publishers, 1992.
5. S. Ramamurthum, "Strength of Materials", Dhanapatrai & Publication, New Delhi

**ME 202- APPLIED THERMODYNAMICS**  
**(CREDITS THEORY-04, PRACTICAL-01)**

**Course code:** ME202

**Contact Hours/Week:** Th: 03, Tu.01, Pr.02

**Course Objective:**

- Apply the laws of thermodynamics to the practical problems.
- To demonstrate thermodynamics cycle and its applications.
- To get conversant with steam engineering.
- To impart the components of thermodynamic cycle.
- To understand the chemistry of combustion and analysis of combustion products.
- Estimate the efficiency of the various engines working on Otto, Diesel, Dual Combustion type of cycles

**Course Outcomes:** At the end of the syllabus completion student will be able to;

- Apply the laws of thermodynamics to the practical problems.
- Know the procedure of measuring the performance among heat pump, heat engine and a refrigerator.
- Demonstrate the knowledge on the concept of entropy.
- Gain the knowledge in analyzing the mixtures of perfect gases.
- Gain the knowledge in estimating the efficiency of the various engines working on Otto, Diesel, and combustion type of cycles.

**Evaluation Scheme:**

<b>Theory</b>	<b>Practical</b>
Mid Term :30 Marks	Continuous Evaluation : 50%
End Term:70Marks	Practical Examination : 50%

**Course Content:**

**Laws of Thermodynamics:**-Joule's experiment, First law of thermodynamics for a cyclic & non cyclic process, energy, perpetual motion machine of the first kind (PMM-I), energy balance in steady flow, some steady-flow devices, Limitations of the first law of thermodynamics, thermal reservoir, heat engine, refrigerator, heat pump, statements of the second law of thermodynamics, perpetual motion machine of the second type (PMM-II), reversible process, irreversible processes, actual processes

**Entropy:** Clausius' theorem, Clausius inequality, entropy, change of entropy in a reversible process T-s diagram, the increase of entropy principle, entropy transfer, entropy generation, entropy balance, physical concept of entropy, T-dS relations, third law of thermodynamics.

**Steam:** Substance, phases of a pure substance, phase-change phenomenon of a pure substance,

terminology of pure substances, property diagrams, P-V-T surface, critical point and triple point, t-s and h-s diagrams, enthalpy changes during formation of steam, wet steam, superheated steam, specific volume of steam, entropy of a pure substance, external work done during evaporation, internal latent heat, internal energy of steam, use of steam tables, Boiler systems, comparison between fire tube and water tube boilers, fire-tube boilers, water tube boilers, some industrial boilers, high-pressure boilers, performance of boilers, boiler mountings and boiler accessories.

**Air Standard Cycle:** Introduction, Carnot cycle, Otto cycle, Diesel cycle, Dual combustion cycle, Brayton cycle.

**Vapour power Cycle:** Properties of steam, Carnot cycle, Rankine cycle, Modified Rankine cycle, Regenerative cycle, reheat cycle

**Nozzle:** Types of nozzle, flow through steam nozzle, mass of steam discharged through a nozzle, condition for maximum discharge, critical pressure ratio, general relationship between area, velocity and pressure, steam injector.

**Air compressors:** classification of air compressors, Terminology, single stage reciprocating air compressor, performance of single stage & multistage air compression, advantages and disadvantages, two stage air compressor with perfect intercooling & imperfect intercooling, minimum work required for a two stage compressor with perfect intercooling, Comparison between reciprocating and rotary compressors, classification of rotary compressors, roots blower compressor, vane blower compressor, centrifugal compressor, comparison between centrifugal and axial compressor

**Fuels and combustion:** Types of fuel, combustion of solid and liquid fuels, minimum air required for complete combustion of solid or liquid fuels, combustion of gaseous fuel, minimum air required for complete combustion of gaseous fuel, mass of excess air supplied, conversion of volumetric analysis into mass (gravimetric) analysis, conversion of mass analysis into volumetric analysis, flue gas analysis.

### **Term Work:**

#### **Part-I: Assignments**

1. Numerical based on above syllabus
2. Record of at least three assignments preferably based on latest development in a particular field based on above syllabus. The students have to give a presentation on a selected topic in field of recent developments.

#### **Part-II: Laboratory work**

Conduct of following experiments;

1. To determine volumetric, isothermal & isentropic efficiency of two stage reciprocating air compressor.
2. To determine volumetric, isothermal efficiency of rotary air compressor.
3. To study cooling tower and find its efficiency.
4. Determination of calorific value of solid/liquid fuel by using Bomb calorimeter.
5. To determine the dryness fraction of wet steam by using Separating throttling calorimeter

6. Study of Cochran boiler.
7. Study of Babcock and Wilcox boiler.
8. Study of Lancashire boiler.
9. Study of Locomotive boiler.
10. Study of boiler mountings and accessories.
11. To determine calorific value of gases fuel by Junkers Gas Calorimeter..

**Practical Examination:**

- End Term practical Examination shall be a practical /oral examination.

**Reference Books:**

1. R. K. Rajput, "Thermal Engineering", Laxmi Publications Pvt. Ltd, New Delhi.
2. B. K. Sarkar, "Thermal Engineering", Tata McGraw Hill Publishing Company Ltd. New Delhi.
3. P. K. Nag, "Engineering Thermodynamics", Tata McGraw Hill Publishing Company Ltd. New Delhi.
4. J. Selwin Rajadurai, "Thermodynamics and Thermal Engineering", New Age International Publishers, New Delhi
5. D. S. Kumar, "Engineering Thermodynamics", S. K. Kataria & Sons, New Delhi.

**ME203 – MECHANICAL MEASUREMENTS AND METROLOGY****(CREDITS THEORY:04, PRACTICAL: 01)****Course code:** ME203**Contact Hours/Week:** Th.03,Tu.01. Pr.02**Course Objective:**

- To demonstrate the basic principles, construction and working of engineering mechanical measurement science.
- To inculcate proficiency in using, calibrating various measurement systems.
- To acquaint the problems in measurement system and develop the competency to resolve the problems.
- To motivate students to use the basic measuring instruments required in industry.

**Course Outcomes:** student will be able to;

- Show knowledge and hands-on competence in applying the concepts of measurement and metrology in the design and development of mechanical systems.
- Demonstrates creativeness in designing new systems components and processes in the field of engineering.
- Work effectively with engineering and science teams as well as with multidisciplinary designs.
- Skilfully use modern engineering tools and techniques for mechanical engineering design, analysis and application
- Differentiate the accuracy of instruments.
- Evaluate quality of job, machine and instruments.
- Perform calibration of measuring instruments.

**Evaluation Scheme:**

<b>Theory</b>	<b>Practical</b>
Mid Term: 30 Marks	Continuous Evaluation: 50 %
End Term: 70Marks	Practical Examination: 50 %

**Course Content:****MECHANICAL MEASUREMENTS**

**Mechanical Measurement:** Need of mechanical measurement, Instruments, Measurement methods, Generalized measurement system, Static performance characteristics, Errors and their classification.

**Transducers:** Classification and various types of transducers

**Measurement of strain:** Introduction, classification of strain gauges, Gauge factor, Temperature compensation, Quarter, Half and Full Bridge circuit, Application to measurement of load/force, Torque.

**Measurement of Pressure:** importance of pressure and vacuum measurement, Range of high pressure and vacuum, Bourdon tubes, Dead weight pressure gauge testers, Diaphragm gauge, LVDT, Piezoelectric pressure gauge, MCLeod gauge, Thermal conductivity gauge.

**Measurement of flow:** Importance of flow measurement, Water meter, Turbine meter, Rota meter, Air/Gas flow meter, Hot wire anemometer, Electromagnetic flow meter, Venturimeter, Pitot tube..

**Temperature Measurement:** Importance of Temperature Measurement, Thermometers, Themisters, Thermocouples and its laws, Pyrometers.

**Speed Measurement:** Importance of Angular Speed Measurement, Tachometer-Mechanical and Eddy current type, Mechanical counter, Stroboscope, Non-contact type counters-Inductive pickup, capacitive pickup and photoelectric pickup.

## **METROLOGY**

**Introduction:** Definition, Linear measurement – Standards, Classification of standards, Vanier calliper, Height gauge, Depth gauge, Feeler gauge, Slip gauge, Micrometer.

**Limits, Fits and Gauges :** Terminology, Definitions, Hole basis and Shaft basis system, Limit, Fits, Tolerances, Taylor's principle of gauge design, Principles of gauge design (Simple numerical problems on limits of size, tolerances etc.), Types of gauges, Interchangeability, Selective assembly.

**Comparators:** Types and working principles of mechanical, pneumatic, electronic, optical, electrical comparators and their applications.

**Interferometry:** Principles of interferometry, Sources of light, Optical flat, Fringe patterns, Toolmakers microscope, Profile projector.

**Surface Finish Measurement:** Definitions, Surface texture terminology, Measurement of surface roughness, Symbols and values of surface roughness.

**Angular Measurement:** Bevel protractor, Sine bar, Sine center and table, Angle gauge, Clinometer, Autocollimator, Angle dekkor.

**Metrology of Screw Threads / Gear Metrology:** Screw thread terminology, Screw thread micrometer, Floating carriage micrometer.

Gear terminology, Measurement of tooth thickness by gear tooth vernier caliper.

**Advances in Metrology:** Universal Measuring, Applications of LASER in measurement, Metro scope, Automatic inspection system.

### **Practical Work:**

#### **Mechanical Measurement (Any five)**

- 1) Study of Generalized Measurement System with typical instrument.
- 2) Temperature measurement using Thermocouple, Themister and Pyrometers.
- 3) Experiment on pressure measurement:- U-tube manometer, Bourdon tube, DeadWeight tester.
- 4) Flow measurement using Rota meter / Water meter.
- 5) Angular speed measurement using stroboscope, pickups and tachometers.



- 6) Experiment on Force / Torque measuring instruments:- Spring balance, Proving ring, Dynamometer.
- 7) Study of LVDT.

**Metrology (Any five)**

- 1) Study of precision measuring instruments for linear measurement.
- 2) Study of comparator of different types.
- 3) Experiment on sine bar for measurement of taper angle.
- 4) Study of autocollimator/angle dekkor
- 5) Study and applications profile projector and Tool maker's microscope.
- 6) Measurement of screw thread using floating carriage micrometer.
- 7) Measurement of gear tooth thickness by gear tooth vernier caliper.
- 8) Assignment on design of gauges.

**Practical Examination:**

End Term Examination shall be a practical/oral examination.

**Reference Books:**

1. Beckwith & Buck, Mechanical Measurement,- McGraw Hill publication,2009.
2. Donald P. Eckman, Industrial Instrumentation,Wiley eastern Ltd.
3. Dobler, Metrology,Tata McGraw Hill Co. New Delhi.
4. D.S. Kumar, Mechanical Measurement and control, Metropolitan Book Company, 1979
5. R. .K Jain, Mechanical Measurement, - Khanna publication, New Delhi.

**ME204– ENGINEERING METALLURGY**  
**(CREDITS THEORY - 03, PRACTICAL - 01)**

Course code: ME204

Contact Hours /Week: Th. 03 Pr.02

**Course Objective:**

- To impart various mechanical properties of materials.
- To demonstrate how and why the properties of materials are controlled by its structure at the microscopic and macroscopic levels.
- To demonstrate the inter-relationship between composition, structure and properties of engineering materials.
- To motivate the students to get knowledge about different materials, their properties and application.

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

- Demonstrate the process of manufacturing of steel and allied metals.
- Demonstrate the process of heat treatment and become able to select material for use/ designing a components.
- Acquire knowledge and hands-on competence in applying the concepts of material science in the design and development of mechanical systems.

**Evaluation Scheme:**

Theory	Practical
Mid Term : 30 Marks	Continuous Evaluation : 50%
End Term : 70Marks	Practical Examination : 50%

**Course Content:**

**Introduction:** Pig iron Production, Manufacture of steel, by Basic oxygen steel making, Electric Arc steel making. Introduction to phase diagram

**Steel as an Engineering Alloy:** Iron –Iron carbide equilibrium diagram, non-equilibrium cooling of steels, classification and applications of steel, specifications of steel, transformation products of austenite, time Temperature transformation (TTT) diagrams, Austenite and ferritic grain size in steels.

**Cast Iron:** White C.I. Gray C.I. malleable C.I., Nodular cast iron, Alloy cast irons and heat treatment of cast irons.

**Heat Treatment of Steel:** Conventional annealing, Bright annealing, box annealing, Isothermal (cycle) annealing, Spheroidised annealing, Subcritical annealing, Normalising, Hardening, Retention of austenite, Effect of retained austenite, elimination of retained austenite, Tempering, Secondary hardening, Temper brittleness, Quench cracks, Hardenability, Carburizing, Selective carburizing, heat treatment after carburizing, Nitriding, Carbo-nitriding, flame hardening, Induction hardening.

**Engineering Non-Ferrous Metals:** Copper and copper alloys, Brasses, Aluminum and Aluminum alloys, Nickel and Nickel alloys, Tin and tin alloys and Bearing materials.

**Powder Metallurgy:** Introduction, characterization and testing of metal powders, powder manufacture, powder conditioning, Oil impregnated bearings, cemented carbide, cermets, advantages

and limitations of powder metallurgy.

**Composite Materials:** Different composite materials and its application in manufacturing processes.

**Term Work:**

The term - work shall consist of a journal based on the below mentioned laboratory experiments/study (at least 8).

1. Study of metallurgical microscope.
2. Preparation of specimen for microscopic examination by mounting.
3. Study of microstructure of plain carbon steels of various compositions.
4. Study of microstructure of various types of C.I.
5. Study of microstructure of various types of alloy steels.
6. Study of microstructure of non – ferrous metals and their alloys.
7. Determination of hardenability of steel material by Jominy End Quench test.
8. Study of surface hardening processes and microstructures.

**Practical Examination:** It shall consist of oral/practical examination based on above syllabus.

**Reference Books:**

1. Sidney H. Avner, "Introduction to Physical Metallurgy", Tata McGraw-Hill Education, 1997
2. R. Higgis, "Engineering Metallurgy Applied Physical Metallurgy, Sixth Edition, Butterworth-Heinemann.
3. V. Raghavan, "Physical Metallurgy Principles and practice".
4. V.D. Kodgire, "Material Science And Metallurgy For Engineers" Everest Publication House.
5. R. Balasubramaniam, "Calister's Materials Science and Engineering" Wiley

**ME205 – MANUFACTURING PROCESSES-I**  
**(CREDITS THEORY - 03, PRACTICAL - 01)**

**Course code:** ME205

**Contact Hours /Week:** Th. 03, Pr.02

**Course Objective:**

- Understand the fundamentals and principles of casting, welding and certain metal working manufacturing processes.
- Understand the various machinery and equipment required to perform the processes.
- Understand and apprehend various applications of the processes.

**Course Outcomes:**

- Able to classify the manufacturing processes.
- Demonstrate the knowledge of manufacturing processes
- Select the manufacturing process for the particular engineering components.
- Acquire knowledge and hands-on competence in applying the concepts of manufacturing.

**Evaluation Scheme:**

Theory	Practical
Mid Term : 30 Marks	Continuous Evaluation : 50%
End Term : 70Marks	Practical Examination : 50%

**Course Content:**

**Introduction:** Concept of Manufacturing Process, Classification of manufacturing process

**Casting:** Introduction to casting process and steps involved. Verities of component produced by casting process. Special molding and casting processes – Lost Foam Process, Shell Molding, Investment casting, Die casting, Centrifugal casting, and Continuous casting. Melting, Pouring and Feeding. Furnaces – Types – Cupola - Construction, operation, zones, Chemistry, etc. Gating system, advantages and limitations of casting process. Pattern Making, Molding and Casting : Sand casting, pattern types, materials, pattern making allowances, molding sand types, properties and testing, hand and machine molding process and equipments, core type and manufacturing. Design of casting: Solidification and Cooling, Riser and Gating design, design consideration in casting. Cleaning and Inspection of casting: Defects in casting. Inspection and Testing, NDT methods.

**Processing of Plastics:** Introduction of plastic molding – Various plastics molding processes and materials

**Welding:** Arc welding- Theory, SMAW, GTAW, GMAW, FCAW, Submerged arc welding, Stud welding Resistance welding- Theory, spot and seam projection welding processes Gas welding Friction welding, Ultrasonic welding, Thermit welding, EBW and LASER welding. Use of adhesive for joining, classification of adhesives, types of adhesive and their application, surface preparation and various joints welding defects and quality.

**Hot and Cold Working of Metals:** Principles of rolling, forging, drop, press, upset, roll forging,

extrusion, drawing, spinning, and effect of hot working. Cold working processes, Cold rolling, swaging, forging, extrusion- forward, backward and impact roll forming, tube drawing, wire drawing, spinning, shot penning, high energy rate forming.

**Term Work:**

The term work shall include numerical assignments and study assignments on below mentioned topics:

1. Study of Sand Testing Equipment's
2. Study of Cupola
3. Study of Casting
4. Study of NDT methods
5. Study of Arc Welding
6. Study of Gas Welding
7. Study of Processing of Plastics
8. Study of Metal working processes
9. Pattern making
10. Mould and Core Making
11. One Job on welding

(While writing study assignments it is desirable to visit laboratory/industrial set up in addition to referring the text and reference books.)

**Practical Examination:** It shall consist of oral/practical examination based on above syllabus.

**Reference Books:**

1. P. N. Rao – “Manufacturing Technology (Foundry, Forming and Welding)” 2<sup>nd</sup> Edition (TMH)
2. Hajra Choudhary – “Elements of Workshop Technology- Vol. I Manufacturing Processes”,
3. Chapman W.A.-“Workshop Technology, Vol. I, II, & III”, Edward Arnold Pub. Ltd. London.
4. Serope Kalpakjian– “Manufacturing Engineering and Technology” – Prentice Hall, Sixth Edition.
5. HMT Hand book- Production Technology
6. Roy A. & Linberg- “Processes and materials of manufacturing”, Prentice Hall of India Delhi.
7. Campbell J.S.: Principles of Manufacturing Materials and Processes, McGraw-Hill, New York.
8. Begeman - “Manufacturing Processes”, Asia Publishing House, Bombay.

**HS222– HUMAN VALUES & PROFESSIONAL ETHICS**  
(CREDITS THEORY - 02)

Course code: HS222

Contact Hours /Week: Th. 02

**Course Objective:**

- Making the students aware and sensitive to value system in real life situations.
- To help the students to discriminate between ephemeral and eternal values.
- To discriminate between essence and form.

**Course Outcomes:**

- Student will be sensitive and helpful towards society and nation
- Student will understand the targets/ aims in human life and set the goal of life.
- Student will become responsible to society and nation

**Evaluation Scheme:**

Theory	Practical
Mid Term : 30* Marks	-----
End Term : 70Marks	-----

\*30 marks- The marks can be awarded on the basis of formal Midterm Examination or sessional or assignments as prescribed by the concerned subject teacher(s) and the course co-ordinator for the specific semester/ academic year. As per the schedule of the Institute, end term examination for 70 marks will be held

**Course Content:**

**Need, Basic Guidelines, Content and Process for Value Education:** Understanding the need, basic guidelines, content and process for Value Education, A look at basic aspirations: Self Exploration, Happiness and Prosperity, Fulfillment of human aspirations and harmony.

**Understanding the Harmony:** Thoughtful human being harmony, sentient, attitude and its importance in relationship Significance of restraint and health (Yama and Niyama), Human goal settings and life management techniques, existence and co-existence, trust, respect in universal order.

**Understanding professional Ethics:** Harmony at various levels and understanding professional ethics, Creating environmentally aware engineers, Humanistic universal education, natural acceptance of human values, ethical human conduct.

**Competence of professional ethics:** Management models for present technologies, strategies for integrating humans in family and at all levels of existence, Relevance of the above strategies in becoming responsible engineers, technologists and managers.

**Motivation:** Contribution of ancestors in science and technology development to raise self esteem in Indian context.

**Reference Books:**

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Value Education.
2. A Nagraj, 1998, Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak.

3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Purblishers.
5. A.N. Tripathy, 2003, Human Values, New Age International Publishers
6. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen(Vaidik) Krishi Tantra Shodh, Amravati.
7. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome’s report, Universe Books.
8. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press
9. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd
10. Subroto Bagchi, The Professional
11. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
12. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008. Scheme and Syllabus Bachelor of Computer.

**MA203 – MATHEMATICS-(III)****(CREDITS THEORY:04)****Course code:** MA203**Contact Hours/Week:** Th.04**Course Objective:**

- To acquaint student with: the basic concepts of an ordinary differential equations, partial differential equations,
- Mathematical Modelling in physical problems.
- Initial and boundary value problems.
- Motivate students to use critical thinking skill to solve practical problems.

**Course Outcomes:** At the end of the course the student is expected to understand:

- Importance of differential equations i.e. ODE and PDE in physical problems.
- Able to solve IVP in electrical and mechanical problems.
- Analysing physical phenomena in engineering and technology by using this theory.

**Evaluation Scheme:**

<b>Theory</b>	<b>Practical</b>
Mid Term: 30 Marks	---
End Term: 70Marks	---

**Course Content:****Unit-1**

Basic Concepts & Ideas, Geometric Meaning of  $y' = f(x, y)$ , direction field, exact equations, Integrating factors, Linear differential equation, Bernoulli's equations, orthogonal trajectories, applications to electrical circuits.

**Unit-2**

Second Order Differential equations, Homogeneous linear differential equation for real & complex roots, Euler Cauchy equation, existence & uniqueness theorem (Without proof) & Wronskian.

**Unit-3**

Non homogeneous equation, solutions by undetermined coefficients & Variation of parameter methods, modelling, forced oscillation, resonance & electrical circuits, system of differential equations.

**Unit-4**

Fourier Series, Periodic function, Fourier theorem Euler's formulae for the Fourier coefficients, convergence of Fourier series, change of interval, even & odd function functions, half range Fourier series.

**Unit-5**

Partial differential equations, Separation of Variables, Vibrations of string, one dimensional equation



**Reference Books:**

1. Advanced Engineering Mathematics – R.K Jain & S.R.K Iyenger
2. Advanced Engineering Mathematics- Erwin Kreyszig
3. Elementary Differential Equation(eighth edition) W.E Boyce & R. Dprima (John Wiley 2005)
4. Fourier series & boundary Valued Problems., R.V Churchill & JW Brown(Seventh edition) Mc Graw Hill(2006).

**ME206 – THEORY OF MACHINES**  
**(CREDITS THEORY:03, PRACTICAL: 01)**

**Course code:** ME206

**Contact Hours/Week: Th: 03, Pr.02**

**Course Objective:**

- To demonstrate commonly used mechanisms for industrial applications.
- To develop competency in drawing velocity and acceleration diagrams for simple and complex mechanisms.
- To impart the concepts of motion transmission elements.

**Course Outcomes:** Student will be able to;

- Demonstrate the working of different mechanisms.
- Draw inversions and determine velocity and acceleration of different mechanisms.
- Construct different types of cam profile for a given data.
- Calculate loss of power due to friction in various machine elements.
- Solve problems on power transmission and construct turning moment diagram.

**Evaluation Scheme:**

Theory	Practical
Mid Term: 30 Marks	Continuous Evaluation: 50 %
End Term: 70Marks	Practical Examination: 50 %

**Course Content:**

**Basic concept:** Links, Kinematics pairs, Kinematics pairs giving one, two & three degrees of freedom, Kinematics chains, Degree of freedom & mobility criteria. Constrained kinematics chains as mechanisms. Inversions of four bar chains. Inversions of single & double slider crank chain & their applications.

**Motion Characteristics of Mechanisms:** Velocity & Acceleration analysis of mechanisms with single degree of freedom system using graphical method. Instantaneous Center, Kennedy's theorem, analysis of velocity of mechanisms using instantaneous centre method.

**Cams:** Introduction, Types of Cams, Types of followers, Follower motions, viz. Simple Harmonic Motion, Constant Velocity, Uniform Acceleration & Retardation, Cycloidal motion, layout of Cam profile for specified displacement characteristics. Cams with Oscillating follower system.

**Gears:** Classification, Gear Terminology, Law of Gearing, profiles used in gears, Length of path of contact, Arc of contact, contact ratio, Interference of involutes teeth, methods of preventing interference & under cutting.

**Flywheel & Governors:** -Turning Moment Diagram for single cylinder & multi-cylinder engine, Flywheel and its applications. Introduction, types of governors- Porter, Proell & Hartnell governor.

**Gyroscope:** Gyroscopic couple, Effect of precision motion on the stability of moving vehicles such as motor car, motor cycle, air plane and ship.

**Term Work:** The term work shall consist of conduct of minimum eight experiments based on above syllabus

**List of Experiments:**

1. To Plot Relevant Displacements Between Crank and Rocker of Four Bar Mechanism
2. To Plot Relevant Displacements Between Crank and Slider of Slider Crank Mechanism
3. To Plot Relevant Displacements Between Crank and Slider of Whitworth Quick Return Mechanism
4. To Plot Relevant Displacements Between Crank and Slider of Scotch Yoke Mechanism
5. To Determine Corioli's Component of Acceleration Theoretically and Experimentally
6. To Determine the Characteristic Curves, Sensitiveness and Range of Speed of Watt Governor
7. To Determine the Characteristic Curves, Sensitiveness and Range of Speed of Porter Governor
8. To Determine the Characteristic Curves, Sensitiveness and Range of Speed of Proell Governor
9. To Determine the Characteristic Curves, Sensitiveness and Range of Speed of Hartnell Governor
10. To Determine Gyroscopic Couple on Motorized Gyroscope

**List of Assignments.**

1. At least one sheet consisting of 2 problems on Velocity analysis by instantaneous centre method.
2. At least one sheet consisting of 2 problems on Velocity analysis by relative velocity method.
3. At least one sheet consisting of 2 problems on Acceleration analysis.
4. At least one sheet consisting of 2 problems on Cam.

**Practical Examination:**

End term practical examination shall be a practical/ oral examination.

**Reference Books:**

1. Bevan T., "Theory of Machines: a text book for engineering students", 3 rd Edition, CBS, New Delhi.
2. Rattan, S.S.: "Theory of Machines", 2 nd Edition, Tata McGraw-Hill, Publishing Co. Ltd., New Delhi, 2006.
3. Ballaney, P. "Theory if Machines and Mechanisms", Khanna Publications.
4. UickerJr, J. J., Penock G. R. and Shigley, J. E. "Theory of Machines and Mechanisms' 3 rd Edition, Oxford University Press, Tata McGraw Hill. 2005.
5. Ghosh, A, and Malick, A. K. "Theory of Mechanisms and Machines" 3 rd Edition, East West Press Pvt. Ltd., 2000.
6. Rao, J.S., and Dukupati, R.V.: "Mechanism and Machine Theory", Wiley Eastern Ltd.

**ME 207-FLUID MECHANICS & HYDRAULIC MACHINES****CREDITS: THEORY-04, PRACTICAL-01****Course code:** ME207**Contact Hours /Week:** Th. 03,Tu.01,Pr.02**Course Objective:**

- To familiarize the students with fluid statics and fluid dynamics.
- To find the losses occurs in flow through the pipes.
- To demonstrate the types of flows and equation of continuity.
- To introduce the concepts of the working and design aspects of hydraulic machines like turbines and pumps and their applications.
- To impart about hydroelectric power plant and estimation of hydropower potential

**Course Outcomes:**

- Student will be able to develop to gain basic knowledge on Fluid Statics, Fluid Dynamics, closed conduit flows, hydro-electric power stations.
- Student will be able to design various components of pumps and turbines and study their characteristics.
- This study is also used for the estimation of efficiency of different pumps and performance of the pumps with the study of characteristics curves.
- Study is used for the design and planning of Hydroelectric Power plant with the available water resources and requirement of power.

**Evaluation Scheme:**

<b>Theory</b>	<b>Practical</b>
Mid Term: 30 Marks	Continuous Evaluation: 50 %
End Term: 70Marks	Practical Examination: 50 %

**Course content:**

**Fluid Statics: Dimensions and Units:** Physical properties of fluids – mass density, specific weight, specific volume, specific gravity, viscosity, surface tension, vapour pressure and their influence on fluid motion. Atmospheric pressure, gauge pressure and vacuum pressure, measurement of pressure – Piezometers, U-tube and differential manometers – mechanical pressure gauges.

**Fluid Kinematics:** Stream line, path line and streak lines and stream tubes. Classification of flows ideal fluid and real fluid – steady and unsteady flows, uniform and non-uniform flows, laminar and turbulent flows, rotational and irrotational flows, equation of continuity for one-dimensional flows.

**Fluid Dynamics:** Various forces acting on a fluid element- Euler's and Bernoulli's equation for flow along a streamline, momentum equation and its applications for pipe bend problem. Closed conduit flow – Reynolds number, Reynolds 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, venturimeter, orificemeter and flow nozzle meter.

**Hydro-Electric Power Stations :** types – concept of pumped storage plants – storage requirements, mass curve, estimation of storage capacity for a uniform demand, estimation of power developed from a given catchment area, heads and efficiencies.

**Basics of Turbo Machinery :**Hydrodynamic force on 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 – Impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine – working principles, workdone, 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 turbines, cavitation, surge tank, water hammer.

**Centrifugal and Reciprocating Pumps:** Classification working of centrifugal pump, work done – manometric head – losses and efficiencies – specific speed – pumps in series and parallel – performance characteristic curves, NPSH. Working of reciprocating pumps, discharge, slip, percentage slip, Indication diagrams.

**Term Work:**

The term work shall consist of conduct of minimum eight experiments based on above syllabus and assignment..

**Practical Examination:**

Practical examination consists of practical/ oral examination based on above syllabus.

**Text Book:**

1. Dr. R.K. Bansal “A Text book of Fluid Mechanics and Hydraulic Machines”, 9th Edition, Laxmi Publications Pvt. Ltd., New Delhi, 2010.
2. R.K. Rajput “A text book of Fluid Mechanics and Hydraulic Machines”, 5th Edition, S.Chand & Company (Ltd) New Delhi, 2009.

**Reference Book:**

1. D.S. Kumar, “Fluid Mechanics and Fluid Power Engineering”, 2nd Edition, SK. Katania and Sons, 2010.
2. P.N. Modi and S.M. Seth “Hydraulics, fluid mechanics and hydraulic machinery”, 14th Edition, Standard Book House, New Delhi 2002.
3. A.K.Jain, “Fluid Mechanics Including Hydraulic Machines”, 8th Edition, Khanna Publishers, New Delhi, 2003.
4. Cengel and Cimbala , " Fluid Mechanics Fundamentals and Applications" McGraw-Hill

**ME208 – MANUFACTURING PROCESSES-II**  
**(CREDITS THEORY 03, PRACTICAL 01)**

**Course code:** ME208

**Contact Hours:** Th. 03, Pr.02

**Course Objective:**

- To impart the fundamentals of metal cutting process.
- To impart the concepts of different machining processes.
- To motivate the students to get known construction, working and applications of various machine tools.
- To make familiar with concepts and working of nonconventional machining process.

**Course Outcomes:**

- Student will demonstrate the metal cutting process and select the tools for it.
- Student will understand the selection procedure of machines for manufacturing engineering components.
- Student will demonstrate principles/working of different machines.
- Student will demonstrate the basics of precision and non conventional machining processes.

**Evaluation Scheme:**

<b>Theory</b>	<b>Practical</b>
Mid Term :30 Marks	Continuous Evaluation :50 %
End Term:70Marks	Practical Examination : 50 %

**Course Content:**

**Introduction:** Definition, principles, types, components, machining parameters, drives and power requirements.

**Theory of Metal Cutting:** Metal cutting process, Orthogonal cutting and force diagram, Tool geometry of single point cutting tool, tool signature, Merchant's circle, Force measurement by dynamometers, effect of tool angles on machining, Tool materials - properties, selection and applications. Chip-formation, types of chips, built-up-edge, chip breakers. Cutting Tool Materials, Machinability, Factors affecting machinability index, Tool Life, Factors affecting tool life, Taylor's equation, types of tool failures, tool wears, Tool condition monitoring.

**Turning:** Turning and Boring, Lathe: construction, accessories and operations, concept of speed, feed and depth of cut, Thread cutting: single and multi-start threading. Introduction to Boring Machines, Capstan and Turret lathe.

**Drilling:** Fundamentals of drilling processes, introduction to multi-point cutting tools, drill geometry, tool holder, types of drill, types of drilling machines, operations performed on drilling machines. Reaming processes and reamer types.

**Milling, Shaping and Planing:** Fundamental aspects, cutter types and geometry, Operations performed on milling machine, dividing head method of indexing. Construction, working and operations performed on shaper, planer, and broaching machines, Introduction to Gear Manufacturing.

**Finishing and Super Finishing:** Grinding wheels, wheel marking, wheel selection, wheel mounting,

types of grinding machines. Honing, lapping, super finishing, buffing and burnishing processes

**Non-Conventional Machining:** Introduction, Classification. Principle, Working and Applications of Chemical Machining, Electrochemical Machining, Electric Discharge Machining (EDM), Wirecut EDM, Abrasive Jet Machining and types, Laser Beam Machining, Plasma Arc Cutting.

**Term Work:**

Each candidate shall be required to complete and submit the following term work.

**Part A:** One composite job consisting of Turning, Facing, Threading, Parting, Drilling and Boring operations.

**Part B:** One job should be made on any one non-conventional machining process.

**Practical Examination:**

Practical examination consists of practical/ oral examination based on above syllabus.

**Reference Books:**

1. Serope Kalpakjian– “Manufacturing Engineering and Technology” – Prentice Hall, Sixth edition
2. Amitabha Ghosh and Asok Kumar Mallik, Manufacturing Science, 1985, Affiliated East West Press Pvt. Ltd., New Delhi.
3. Hajra Choudhary – “Elements of workshop technology- vol. I & II manufacturing processes”.
4. Chapman W.A.-“Workshop Technology”, vol. II, II, & IV, Edward Arnold pub. Ltd. London.
5. P. N. Rao – “manufacturing technology (foundry, forming and welding)” 2<sup>nd</sup> edition (TMH).
6. R. K. Jain, ‘Production Technology’, Khanna Publications.

**ME209 – MACHINE DRAWING AND COMPUTER AIDED DRAFTING****(CREDITS THEORY - 02, PRACTICAL - 01)****Course code:** ME209**Contact Hours/Week:** Th.02, Pr.02**Course Objective:**

- To make familiar with the principles and requirements of production drawings.
- To make aware of the various symbols used in drawing.
- To motivate for reading assembly drawings and details.
- To acquaint the concept of Bill of Materials.
- To motivate for learning use of various CAD techniques along with software.

**Course Outcomes:**

- Identify the elements of a detail drawing and create a simple detail drawing complete with annotation
- List the common elements of a title block and record strip
- Construct a bill of materials including purchased parts and create a typical drawing sequence numbers.
- Construct an assembly drawing of a machine unit list the parts.
- Construct a set of working drawings of a machine assembly including assembly drawings, detail drawings, bill of materials, revisions block, part specifications, and general notes

**Evaluation Scheme:**

<b>Theory</b>	<b>Practical</b>
Mid Term : 30 Marks	Continuous Evaluation : 50%
End Term : 70Marks	Practical Examination : 50%

**Course Content:**

**Introduction:** Introduction to machine drawing, Computer aided drafting and documentation (CADD)

**Conventions:** Conventional representation of standard machine parts, thread profiles and welded joints along with their actual drawings, Conventional representation for various types of springs and gears. Representing limits, fits and tolerances, Representation of Surface Roughness and Textures.

**Production Drawing:** Introduction, Types of production drawings, Detailing or Part Drawings, Working Assembly Drawings, Examples

**Machine Parts:** Screwed Fastenings: Locking Arrangement of Nuts, Foundation Bolts. Pipe Joints: Flanged, Socket and Spigot Joints, Hydraulic, Union Joints, Expansion Joints and Stuffing Box. Riveted Joints: Single and Double Riveted Butt and Lap Joints, Keys, Cotter Joints; Knuckle Joint.

**Assembly and Detail Drawing:** Assembly and detail drawing with complete dimensioning, tolerance, materials and surface finish of different small machines and machine components.

**Computer Aided Drafting and Documentation (CADD):** Introduction, Required Equipment, Starting



AutoCAD, planning for a drawing, types of modeling, Isometric drawing, Basic dimensioning

**Term Work:**

The term work shall consist of record of Computer aided drafting assignments, drawing sheets and sketchbook based on the above syllabus.

**Practical Examination:**

Practical examination consists of practical/ oral examination based on above syllabus.

**Reference Books:**

1. N.D. Bhatt & V.M. Panchal, "Machine Drawing," - Charotar Publishing House, 2001
2. Dr. Dhawan, "A Text Book of Machine Drawing," S. Chand publications 2014
3. Siddheswar, Kannaiyah, and Shastry VVS, "Machine Drawing" , TMH
4. G. Pohit and G. Ghosh, Machine Drawing with AutoCAD –Pearson Education, 2005
5. P.S. Gill, Machine Drawing - S. K. Kataria and Sons, Delhi, 2002
6. Tutorials, manuals and documentation of CAD software.

**ME210 – COMPUTER PROGRAMMING****(CREDITS: PRACTICAL - 01)****Course code:** ME210**Contact Hours/Week:** Pr.02**Course Objective:**

- To familiarize the trainee with the universal concepts of computer programming.
- To present the syntax and semantics of the “C++” language as well as basic data types offered by the language.
- To discuss the principles of the object-oriented model and its implementation in the “C++” language.
- To demonstrate the means useful in resolving typical implementation problems with the help of standard “C++” language libraries.

**Course Outcomes:** At the end of the course student will be;

- Able to differentiate between structures oriented programming and object oriented programming.
- Able to use object oriented programming language like C++ and associated libraries to develop object oriented programs.
- Able to understand and apply various object oriented features like inheritance, data abstraction, encapsulation and polymorphism to solve various computing problems using C++ language
- Able to apply concepts of operator-overloading, constructors and destructors.
- Able to apply exception handling and use built-in classes from STL.

**Evaluation Scheme:**

<b>Theory</b>	<b>Practical</b>
----	Continuous Evaluation : 50%
----	Practical Examination : 50%

**Course Content:**

- Introduction to compiling and software development
- Basic scalar data types, operators, flow control, streamed input/output, conversions
- Declaring, defining and invoking functions
- Strings processing, exceptions handling, dealing with namespaces
- Object-oriented approach and its vocabulary
- Dealing with classes and objects
- Defining overloaded operators
- Introduction to STL

**Term Work:** It will consist of at least six assignments based on above syllabus.

**Practical Examination:**

End Term Examination shall be a practical/oral examination.

**Reference Books:**

1. Balagurusamy , “Object Oriented Programming with C++”, Tata McGraw-Hill Education, 2008
2. Yashwant Kanetkar, “Let Us C++,” Bpb Publications.

**HS 221 – PROFESSIONAL COMMUNICATION**  
(CREDITS THEORY - 02, PRACTICAL - 01)

**Course code:** UHS 221

**Contact Hours/Week:** Th.02, Pr.02

**Course objective:**

- To enable students to speak and write English with a good level of proficiency
- To build confidence in students to face interview, deliver speech, make presentation and participate in meeting and discussion
- To Lay A Strong Foundation On The Subject By Revising And Correcting The Basics

**Course outcomes:**

- Graduates will demonstrate the ability to orally communicate ideas and concepts clearly and in an organized manner.
- Graduates will demonstrate the ability to write clear system documentation, user documentation and research reports.

**Evaluation Scheme:**

<b>Theory</b>	<b>Practical</b>
Mid Term: 30 Marks	Continuous Evaluation : 50%
Mid Term: 70 Marks	Practical Examination : 50%

**Course Content:**

**Functional Grammar:** Building of a sentence and its components, Tense- the time sense: Present, Past and Future tense with uses and applications, Verbs, Noun, Pronoun, Adjective, Adverb, Prepositions and Conjunctions: classification, identifications, uses and applications Active & Passive voice, direct and indirect speech, clause, principles of effective communication.

**Listening Skills:** Requirements of listening skill, Phonetics and phonology, Articulation of consonants and vowels, Syllables, Weak form stress, Rhythm and intonation, Face to face conversation, Telephonic conversation.

**Reading Skills:** Requirements of reading skill, Reading poetry, Reading prose, Reading article from standard news paper/ magazine

**Writing Skills:** Paragraph, Resumes, Letters- formal and informal, Circular, Notice, Agendas, Minutes, Reports, E-mail and Blog writing

**Speaking Skills:** Requirement of speaking skills, Grammatical difficulties, Practice of public speaking,

Conversation between /among students or groups on given situations

**Integration of skills:** Group discussion, Personal interview, Debate and Quiz competition, ppt Presentation,

**Term Work:**

**Practical's and Assignments:**

1. Practice of building of sentences and identification of components
2. Practice the uses and applications of tense
3. Identification of parts of speech and form changes- use in sentences
4. Identification of various clauses and their use in sentences
5. **Listening Skills:** Listen few BBC / Voice of America/ NDTV 24\*7 or similar standard Television channel / Radio or any standard talk/discussion available in CD/DVD and answer the given questions/ write the summery
6. **Reading Skills:** Read few articles from standard news paper The Hindu/ The Times of India / magazine /books and answer the given questions /write the summery
7. **Writing Skills: (Assignments)**
  - a. Write your own CV
  - b. Write an E-mail
  - c. Write a blog on current topic of discussion
  - d. Write a technical report
  - e. Write a letter
  - f. Comprehension Tests
8. **Speaking and Integration of Skills:**
  - a. Converse on few given situations
  - b. Group Discussions on a given topic
  - c. Debate competition on a given topic
  - d. Quiz competition among few groups of students
  - e. ppt presentation

**Practical Examination:**

End Term Examination shall be a practical/oral examination.

**Reference Books:**

1. Essential English Grammar, Raymond Murphy, Cambridge University Press, 1 December, 2007
2. Oxford English Grammar Course: Advanced, Michael Swan and Catherine Walter, Oxford, 24 February, 2012
3. Advanced English Grammar, Martin Hewings, Cambridge University Press, 1 December, 2007
4. Developing Communication Skills, Krishna Mohan and Meera Banerjee, Macmillan India Ltd, New Delhi, 2nd Edition, 2009
5. Oxford Advanced Learner's Dictionary, 8th Edition