M.D. UNIVERSITY, ROHTAK

SCHEME OF STUDIES AND EXAMINATION

B.TECH (MECHANICAL ENGINEERING)

SEMESTER 3rd & 4th

Scheme effective from 2019-20

COURSE CODE AND DEFINITIONS

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional Core Courses
LC	Laboratory Courses
MC	Mandatory Courses
PT	Practical Training
S	Seminar

MAHARSHI DAYANAND UNIVERSITY, ROHTAK

Scheme of Examination for Semester III (Second Year)

B.Tech (MECHANICAL ENGINEERING)w.e.f. 2019-20

Sr. No.	Category Course Notation	Course Code	Course Title	Hours per week			Total Contact hrs/week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Mark of Class work	Theory	Practical	Total	
1	Basic Science course	BSC-ME-201G	Physics II(Optics & Waves)	3	0	0	3	3	25	75		100	3
2	Basic Science course	BSC-ME-203G	Mathematics-III	3	1	0	4	4	25	75		100	3
3.	Basic Science course	BSC-BIO-205G	Biology	2	1	0	3	3	25	75		100	3
4.	Engineering Science course	ESC-ECE-207G	Basics of Electronics Engg.	2	0	0	2	2	25	75		100	3
5.	Engineering Science course	ESC-ME-209G	Engineering Mechanics	3	0	0	3	3	25	75		100	3
6.	Engineering Science course	ESC-ME-211G	Basics of Mechanical Engg.	2	0	0	2	2	25	75		100	3
7.	Professional Core courses	PCC-ME-213G	Thermodynamics	3	1	0	4	4	25	75		100	3
8.	Engineering Science course	LC-ME-215G	Basics of Mechanical Engg. lab	0	0	2	2	1	25		25	50	3
TOTAL CREDIT								**22**				**750**	

MAHARSHI DAYANAND UNIVERSITY, ROHTAK

Scheme of Examination for Semester IV (Second Year)

B.Tech.(MECHANICAL ENGINEERING)w.e.f. 2019-20

Sr. No.	Category Course Notation	Course Code	Course Title	Hours per week			Total Contact hrs/week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Mark of Class work	Theory	Practical	Total	
1	Professional Core courses	PCC-ME-202G	Applied Thermodynamics	3	1	0	4	4	25	75		100	3
2	Professional Core courses	PCC- ME-204G	Fluid Mechanics	3	1	0	4	4	25	75		100	3
3	Professional Core courses	PCC- ME-206G	Strength of materials	3	1	0	4	4	25	75		100	3
4	Professional Core courses	PCC- ME-208G	Materials Engineering	3	0	0	3	3	25	75		100	3
5	Professional Core courses	PCC- ME-210G	Instrumentation & Control	3	0	0	3	3	25	75		100	3
6	Professional Core courses	LC- ME-212G	Applied Thermodynamics Lab	0	0	2	2	1	25		25	50	3
7	Professional Core courses	LC- ME-214G	SOM Lab	0	0	2	2	1	25		25	50	3
8	Professional Core courses	LC- ME-216G	Fluid Mechanics Lab	0	0	2	2	1	25		25	50	3
9	Professional Core courses	LC- ME-218G	Materials Lab	0	0	2	2	1	25		25	50	3
10	Professional Core courses	LC- ME-220G	Instrumentation Lab	0	0	2	2	1	25		25	50	3
11	Mandatory course	*MC-106G	Environment Science	3	0	1	-		25	75		-	4
TOTAL CREDIT								**23**				**750**	

*__MC-106G__ is a mandatory non –credit course in which the students will be required passing marks in theory.

NOTE: At the end of 4th semester each student has to undergo Practical Training of 4/6 weeks in an Industry/ Institute/ Professional Organization/ Research Laboratory/ training centre etc. and submit typed report along with a certificate from the organization & its evaluation shall be carried out in the 5th Semester.

Course code	**BSC-ME- 201G**				
Category	Basic Science course				
Course title	**Physics-II (Optics and Waves)**				
Scheme and Credits	L	T	P	**Credits**	Semester-III
	3	0	0	3	
Objectives:	➢ To acquire skills allowing the student to identify and apply formulas of optics and wave physics using course literature ➢ To be able to identify and illustrate physical concepts and terminology used in optics and to be able to explain them in appropriate detail. ➢ To be able to make approximate judgements about optical and other wave phenomena when necessary				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-1

Simple harmonic motion, damped and forced simple harmonic oscillator, Mechanical and electrical simple harmonic oscillators, differential equation of simple harmonic motion, damped harmonic oscillator , quality factor, forced mechanical and electrical oscillators, steady state motion of forced damped harmonic oscillator.

UNIT-2

Sinusoidal waves (concept of frequency and wavelength), types of waves, the one dimensional wave, transverse vibrations of stretched strings. Longitudinal sound wave in solid, The matrix method in paraxial optics (unit plane and nodal plane) wave group and group velocity, Fermat's principle and its applications (mirage effect, laws of reflection and refraction), Light as an electromagnetic wave and Fresnel equations, reflectance and transmittance, Brewster's angle and total internal reflection.

UNIT-3

Wave optics

Huygen's principle, superposition of waves and interference of light by wavefront splitting and amplitude splitting, Young's double slit experiment, Newton's rings, Michelson interferometer, Fraunhofer's diffraction from a single slit, the Rayleigh criterion for limit of just resolution and its application to vision, Diffraction grating (Transmission), its dispersive and resolving power.

UNIT-4

Lasers

Stimulated and spontaneous emission, Einstein's theory of matter-radiation interaction, Einstein's coefficients, amplification of light by population inversion, Pumping in lasers, three and four level laser systems, different types of lasers: gas lasers (He-Ne, CO_2), solid-state lasers (Ruby, Neodymium), Properties of laser beams: mono-chromaticity, coherence, directionality and intensity, laser speckles, applications of lasers in science, engineering and medicine.

Course Outcomes: On successful completion of this course, students should be able to:

1. Calculate wave properties from a microscopic model.
2. Analyze optical systems (diffraction and interference).

References:

1. I. G. Main, "Vibrations and waves in physics", Cambridge University Press, 1993.

2. H. J. Pain, "The physics of vibrations and waves", Wiley, 2006.

3. E. Hecht, "Optics", Pearson Education, 2008.

4. A. Ghatak, "Optics", McGraw Hill Education, 2012.

5. O. Svelto, "Principles of Lasers", Springer Science & Business Media, 2010.

Course code	**BSC-ME- 203G**				
Category	Basic Science course				
Course title	**Mathematics III (PDE, Probability & Statistics)**				
Scheme and Credits	L	T	P	**Credits**	Semester-III
	3	1	0	4	
Objectives:	(1) To introduce the solution methodologies for second order Partial Differential Equations with applications in engineering (2) To provide an overview of probability and statistics to engineers				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Definition of Partial Differential Equations, First order partial differential equations, solutions of first order linear PDEs; Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method. Second-order linear equations and their classification, Initial and boundary conditions, D'Alembert's solution of the wave equation;

UNIT-II

Duhamel's principle for one dimensional wave equation. Heat diffusion and vibration problems, Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, cylindrical and spherical polar coordinates, solutions with Bessel functions and Legendre functions. One dimensional diffusion equation and its solution by separation of variables.

UNIT-III

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.

Continuous random varibales and their properties, distribution functions and densities, normal, exponential and gamma densities.Bivariate distributions and their properties, distribution of sums

and quotients, conditional densities, Bayes' rule.

UNIT-IV

Basic Statistics, Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, Tests for single mean, difference of means, and difference of standard deviations. Test for ratio of variances – Chisquare test for goodness of fit and independence of attributes.

Course Outcomes:

Upon completion of this course, students will be able to solve field problems in engineering involving PDEs. They can also formulate and solve problems involving random variables and apply statistical methods for analysing experimental data.

Textbooks/References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
3. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
4. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

Course code	**BSC-BIO-205G**				
Category	Basic Science Course				
Course title	**Biology**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-III/ V/ VII**
	2	**1**		**3**	
Branches (B. Tech.)	**All Branches**				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objectives

To convey that Biology as an important scientific discipline.

To convey that "Genetics is to biology what Newton's laws are to Physical Sciences"

To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine
The molecular basis of coding and decoding genetic information is universal.
How to analyse biological processes at the reductionist level

UNIT – I

Introduction to living world: Concept and definition of Biology; Aspect of biology. Need to study biology. Characteristic features of living organisms; Cell theory, Structure of Prokaryotic and Eukaryotic cell. Distinguish between animal and plant cell. Concept of single celled organisms, Ecological aspects of single celled organisms, Types of microbes and their important properties. Economic importance of microbes.

Genetics : Mendel's laws of inheritance, Concept of allele. Concepts of recessiveness and dominance . Gene interaction , Epistasis.
Cell division- Mitosis and Meiosis. Evidence of nucleic acid as a genetic material. Concept of genetic code, Central Dogma.

UNIT – II

Introduction to Biomolecules: Definition, structure and important functions of carbohydrates (glucose, fructose, disaccharides, starch and cellulose), lipids (phospholipid, cholesterol), Amino acids. Proteins- structure and function. Primary secondary, tertiary and quaternary structure.

Nucleic acid- Structure of DNA and RNA, types of RNA, Watson and Crick model of DNA

UNIT – III

Introduction to Genetic Engineering: Concept of genetic engineering. Tools used in recombinant DNA Technology. Restriction enzymes and DNA modifying enzymes, ligases. Gene cloning; plasmid vector. Transgenic plants and animals

UNIT – IV

Applications of Biotechnology: Applications of biotechnology in Agriculture, Medicine, Environment (sewage treatment), enzyme technology.

Course Outcomes

After studying the course, the student will be able to:
Understand about living organisms, type of cells and microbes.
Highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring
Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine
Identify DNA as a genetic material in the molecular basis of information transfer.

References:

1) Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
2) Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H. John Wiley and Sons
3) Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
4) Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
5) Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers

6) https://onlinecourses.nptel.ac.in/noc18_bt23 by K. Suraishkumar and Madhulika Dixit

7) Campbell, NA and Reece JB, Biology, International edition, 7th edition or later, Benjamin Cummings, New York (2007 or later)
8) Karp, G, Cell and Molecular Biology: Concepts and Experiments, 7th edition, Wiley, New York (2013).

Course code	**ESC-ECE-207G**				
Category	Engineering Science course				
Course title	**Basics of Electronic Engineering**				
Scheme and Credits	L	T	P	**Credits**	Semester-III
	2	0	0	2	
Objectives:	To provide an overview of electronic device components to Mechanical engineering students.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Semiconductor Devices and Applications: Introduction to P-N junction Diode and V-I characteristics, Half wave and Full-wave rectifiers, capacitor filter. Zener diode and its characteristics, Zener diode as voltage regulator. Regulated power supply IC based on 78XX and 79XX series, Introduction to BJT, its input-output and transfer characteristics, BJT as a single stage CE amplifier, frequency response and bandwidth.

UNIT-II

Operational amplifier and its applications: Introduction to operational amplifiers, Op-amp input modes and parameters, Op-amp in open loop configuration, op-amp with negative feedback, study of practical op-amp IC 741, inverting and non-inverting amplifier applications: summing and difference amplifier, unity gain buffer, comparator, integrator and differentiator.

UNIT-III

Timing Circuits and Oscillators: RC-timing circuits, IC 555 and its applications as astable and mono-stable multi-vibrators, positive feedback, Barkhausen's criteria for oscillation, R-C phase shift and Wein bridge oscillator.

UNIT-IV

Digital Electronics Fundamentals :Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification using K-map, Logic ICs, half and full adder/subtractor, multiplexers, de-multiplexers, flip-flops, shift registers, counters, Block diagram of microprocessor/microcontroller and their applications.

Electronic Communication Systems: The elements of communication system, IEEE frequency spectrum, Transmission media: wired and wireless, need of modulation, AM and FM modulation
schemes, Mobile communication systems: cellular concept and block diagram of GSM system.

Course Outcomes:

At the end of this course students will demonstrate the ability to
1. Understand the principles of semiconductor devices and their applications.
2. Design an application using Operational amplifier.
3. Understand the working of timing circuits and oscillators.
4. Understand logic gates, flip flop as a building block of digital systems.
5. Learn the basics of Electronic communication system.

Text /Reference Books:

1. Floyd ," Electronic Devices" Pearson Education 9th edition, 2012.
2. R.P. Jain , "Modern Digital Electronics", Tata Mc Graw Hill, 3rd Edition, 2007.
3. Frenzel, "Communication Electronics: Principles and Applications", Tata Mc Graw Hill, 3rd Edition, 2001

Course code	**ESC-ME- 209G**				
Category	Basic Science course				
Course title	**Engineering Mechanics**				
Scheme and Credits	L	T	P	**Credits**	Semester-III
	3	0	0	3	
Objectives:	1. To understand the basic force system. 2. To learn about Applying principles of particle kinematics. 3. To understand the concepts of particle dynamics. 4. To Learn energy methods & momentum methods.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction: Force system, dimensions and units in mechanics, laws of mechanics, vector algebra, addition and subtraction of forces, cross and dot products of vectors, moment of a force about a point and axis, couple and couple moment, transfer of a force to a parallel position, resultant of a force system using vector method, Problems involving vector application

Equilibrium: Static and dynamic equilibrium, static in determinacy, general equations of equilibrium, Varingnon's theorem, Lami's theorem, equilibrium of bodies under a force system, Problems.

UNIT-II

Truss and Frames:Truss, classification of truss, assumptions in truss analysis, perfect truss, analysis of perfect plane truss using method of joints and method of sections, Problems. Centroid , Centre of mass and Centre of gravity, Determination of centroid, centre of mass and centre of gravity by integration method of regular and composite figures and solid objects, Problems.

UNIT-III

Moment of Inertia: Area moment of inertia, mass moment of inertia, parallel axis and perpendicular axis theorems, radius of gyration, polar moment of inertia, product of inertia, principle axis, problem based on composite figures and solid objects.

Kinematics: Concept of rigid body, velocity and acceleration, relative velocity, translation and rotation of rigid bodies, equations of motion for translation and rotation, problems.

UNIT-IV

Particle Dynamics: Energy methods and momentum methods, Newton's laws, work energy equation for a system of particles, linear and angular momentum equations, projectile motion, problem.

Shear Force and Bending Moment Diagram for statically determinant beams Classification of beams, types of loads, shear force and bending moment calculation and their graphical presentation, point of inflection, problem.

Course Outcomes (COs): At the end of the course, the student shall be able to:

1. Understand the basic force system.
2. Apply principles of particle kinematics.
3. Grasp the concepts of particle dynamics.
4. Learn energy methods & momentum methods.

Recommended Books:-

Engineering Mechanics – Irving H. Shames, PHI Publication
Engineering Mechanics – U.C.Jindal, Galgotia Publication
Engineering Mechanics – A.K.Tayal, Umesh Publication

Course code	**ESC-ME-211G**				
Category	Engineering Science courses				
Course title	**Basics of Mechanical Engineering**				
Scheme and Credits	L	T	P	**Credits**	Semester-III
	2	0	0	2	
Objectives:	1. To Learn Manufacturing Processes. 2. To Understand Basic Refrigeration & Air Conditioning Processes. 3. To Understand Hydraulic Turbines & Pumps. 4. To learn power transmission methods.				
Class work mark	25 Marks				
Practical mark	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction to Commonly used Machine Tools in a Workshop : Lathe, Shaper, Planer, Milling, Drilling, Slotter, Introduction to Metal Cutting. Basic concept of thermodynamics Introduction, States, Work, Heat, Temperature, Zeroth, 1st, 2nd and 3rd law of thermodynamics,Concept of internal energy, enthalpy and entropy, Problems.

Properties of Steam & Steam Generator: Formation of steam under constant pressure, Thermodynamic properties of steam, use of steam tables, measurement of dryness fraction by throttling calorimeter.

UNIT-II

Refrigeration & Airconditioning: Introduction to refrigeration and air-conditioning, Rating of refrigeration machines, Coefficient of performance, simple refrigeration vapour compression cycle, Psychrometric charts and its use, Human comforts.

Hydraulic Turbines & Pumps : Introduction, Classification, Construction details and working of Pelton, Francis and Kaplan turbines, Specific speed and selection of turbines, Classification of water pumps and their working.

UNIT-III

Power Transmission Methods and Devices : Introduction to Power transmission, Belt, Rope, Chain and Gear drive, Types and functioning of clutches.

Stresses and Strains : Introduction, Concept & types of stresses and strains, Poison's ratio, stresses and strains in simple and compound bars under axial loading, flexure & torsional loading, Stress-strain diagrams. Hook's law, Elastic constants & their relationships.

UNIT-IV

Introduction to Manufacturing Systems, Fundamentals of Numerical Control (NC). Advantage of NC systems, Classifications of NC, Comparison of NC and CNC.

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

1. Understand the principles and applications of various manufacturing processes.
2. Understand the concept of strain and strain for the strength of materials.
3. Grasp the concepts of power transmission devices.
4. Understand methods of thermodynamics, refrigeration & air conditioning in mechanical system.
5.

Text Books :

1. Elements of Mechanical Engineering- R.K. Rajput LAkmi Pub., Delhi.
2. Elements of Mechanical Engineering- D.S. Kumar, S.K. Kataria and Sons
3. Engineering Thermodynamics - P.K. Nag TMH, New Delhi.
4. Refrigeration & Airconditioning- Arora & Domkundwar, Dhanpat rai & Co. Pvt. Ltd.
5. Worshop Technology Volt. I & II - Hazra & Chaudhary, Asian Book Comp., New Delhi.
6. Process and Materials of Manufacture- Lindberg, R.A. Prentice Hall of India, New Delhi.
7. Principles of Manufacturing Materials and Processes- Compbell, J.S. - McGraw Hill.

Reference Books :

1. Strength of Materials- Popov, Pub. - PHI, New Delhi.
2. Hydraulic Machines- Jagdish Lal, Pub. Metropolitan, Allahabad.
3. Strength of Materials- G.H. Ryder, Pub. ELBS.
4. Hydraulic and Fluid Mechanics- Modi and Seth, Pub.- Standara Book House, New Delhi.
5. Engineering Thermodynamics- C.P. Arora, Pub. - TMH, New Delhi.
6. Refrigeration & Airconditioning- C.P. Arora, Pub. -TMH, New Delhi.
7. Manufacturing Science- Amitabha Ghosh & Ashok Kumar Malik, East-West Press.
8. Manufacturing Process and Systems- Ostwaid, Munoz, John Wiley.
9. Workshop Technology, Vol. 1, 2, & 3- Chapman, WAJ Edward Amold.

Course code	**PCC-ME 213G**				
Category	Professional Core Courses				
Course title	**Thermodynamics**				
Scheme and Credits	L	T	P	**Credits**	
	3	1	0	4	
Objectives:	• To learn about work and heat interactions, and balance of energy between system and its surroundings • To learn about application of I law to various energy conversion devices • To evaluate the changes in properties of substances in various processes • To understand the difference between high grade and low grade energies and II law limitations on energy conversion				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Fundamentals - System & Control volume; Property, State & Process; Exact & Inexact differentials; Work-Thermodynamic definition of work; examples; Displacement work; Path dependence of displacement work and illustrations for simple processes; electrical, magnetic, gravitational, spring and shaft work.

Temperature, Definition of thermal equilibrium and Zeroth law; Temperature scales; Various Thermometers- Definition of heat; examples of heat/work interaction in systems- First Law for Cyclic & Non-cyclic processes; Concept of total energy E ; Demonstration that E is a property; Various modes of energy, Internal energy and Enthalpy.

UNIT-II

Definition of Pure substance, Ideal Gases and ideal gas mixtures, Real gases and real gas mixtures, Compressibility charts- Properties of two phase systems - Const. temperature and Const. pressure heating of water; Definitions of saturated states; P-v-T surface; Use of steam tables and R134a tables; Saturation tables; Superheated tables; Identification of states & determination of properties, Mollier's chart.

UNIT-III

First Law for Flow Processes - Derivation of general energy equation for a control volume; Steady state steady flow processes including throttling; Examples of steady flow devices; Unsteady processes; examples of steady and unsteady I law applications for system and control volume.

Second law - Definitions of direct and reverse heat engines; Definitions of thermal efficiency and COP; Kelvin-Planck and Clausius statements; Definition of reversible process; Internal and external irreversibility; Carnot cycle; Absolute temperature scale.

UNIT-IV

Clausius inequality; Definition of entropy S ; Demonstration that entropy S is a property; Evaluation of S for solids, liquids, ideal gases and ideal gas mixtures undergoing various processes; Determination of s from steam tables- Principle of increase of entropy; Illustration of processes in Ts coordinates; Definition of Isentropic efficiency for compressors, turbines and nozzles-Irreversibility and Availability, Availability function for systems and Control volumes undergoing different processes, Lost work. Second law analysis for a control volume. Exergy balance equation and Exergy analysis.

Thermodynamic cycles - Basic Rankine cycle; Basic Brayton cycle; Basic vapor compression cycle and comparison with Carnot cycle.

Course Outcomes:

1. After completing this course, the students will be able to apply energy balance to systems and control volumes, in situations involving heat and work interactions
2. Students can evaluate changes in thermodynamic properties of substances
3. The students will be able to evaluate the performance of energy conversion devices
4. The students will be able to differentiate between high grade and low grade energies.

Text Books:

1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, Fundamentals of Thermodynamics, John Wiley and Sons.
2. Jones, J. B. and Duggan, R. E., 1996, Engineering Thermodynamics, Prentice-Hall of India
3. Moran, M. J. and Shapiro, H. N., 1999, Fundamentals of Engineering Thermodynamics, John Wiley and Sons.
4. Nag, P.K, 1995, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd.

Course code	LC-ME-215G				
Category	Engineering Science courses				
Course title	Basics of Mechanical Engg. Lab				
Scheme and Credits	L	T	P	**Credits**	
	0	0	2	1	
Objectives:	To understand various basic issues of Mechanical Engineering like IC engines, machines and mechanics of machines.				
Class work mark	25 Marks				
Practical mark	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

List of Experiments

1. To study various types of boilers & also study mountings and accessories in boilers.
2. To study various types of internal Combustions Engines.
3. To calculate the Mechanical Advantage, Velocity Ratio and Efficiency of single start, Double start and Triple start worm & Worm Wheel.
4. To find the Mechanical Advantage, velocity Ratio and Efficiency of a Differential Wheel and Axle.
5. To find Moment of Inertia of a Fly Wheel.
6. Verification of reciprocal theorem of deflection using a simply supported beam.
7. Verification of moment area theorem for slopes and deflections of the beam.
8. Deflections of a truss-horizontal deflections & vertical deflections of various joints of a pin-jointed truss.
9. Elastic displacements (vertical & horizontal) of curved members.
10. Experimental and analytical study of 3 hinged arch and influence line for horizontal thrust.
11. Experimental and analytical study of behavior of struts with various end conditions.
12. To determine elastic properties of a beam.
13. Experiment on a two-hinged arch for horizontal thrust & influence line for Horizontal thrust.
14. Experimental and analytical study of a 3 bar pin jointed Truss.
15. Experimental and analytical study of deflections for unsymmetrical bending of a Cantilever beam.

Course Outcomes: The students who have undergone the course will be able to understand working of IC engines, types of boilers and accessories and understand the basic mechanics.

Note:

1. At least ten experiments are to be performed in the Semester.

SEMESTER-IV

SYLLABUS

Course code	**PCC-ME 202G**				
Category	Professional Core Courses				
Course title	**Applied Thermodynamics**				
Scheme and Credits	L	T	P	**Credits**	Semester-IV
	3	1	0	4	
Objectives:	(1)To learn about of I law for reacting systems and heating value of fuels (2)To learn about gas and vapor cycles and their first law and second law efficiencies (3) To understand about the properties of dry and wet air and the principles of psychrometry (4) To learn about gas dynamics of air flow and steam through nozzles (5) To learn the about reciprocating compressors with and without intercooling (6) To analyze the performance of steam turbines				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction to solid, liquid and gaseous fuels–Stoichiometry, exhaust gas analysis- First law analysis of combustion reactions- Heat calculations using enthalpy tables- Adiabatic flame temperature- Chemical equilibrium and equilibrium composition calculations using free energy.

UNIT-II

Vapor power cycles Rankine cycle with superheat, reheat and regeneration, exergy analysis. Supercritical and ultra super-critical Rankine cycle- Gas power cycles, Air standard Otto, Diesel and Dual cycles-Air standard Brayton cycle, effect of reheat, regeneration and intercooling-Combined gas and vapor power cycles- Vapor compression refrigeration cycles, refrigerants and their properties.

UNIT-III

Properties of dry and wet air, use of pschyrometric chart, processes involving heating/cooling and humidification/dehumidification, dew point.
Basics of compressible flow. Stagnation properties, Isentropic flow of a perfect gas through a nozzle, choked flow, subsonic and supersonic flows- normal shocks- use of ideal gas tables for isentropic flow and normal shock flow- Flow of steam and refrigerant through nozzle, super saturation compressible flow in diffusers, efficiency of nozzle and diffuser.

UNIT-IV

Reciprocating compressors, staging of reciprocating compressors, optimal stage pressure ratio, effect of intercooling, minimum work for multistage reciprocating compressors.
Analysis of steam turbines, velocity and pressure compounding of steam turbines

Course Outcomes:

1. After completing this course, the students will get a good understanding of various practical power
cycles and heat pump cycles.
2. They will be able to analyze energy conversion in various thermal devices such as combustors, air
coolers, nozzles, diffusers, steam turbines and reciprocating compressors
3. They will be able to understand phenomena occurring in high speed compressible flows

Text Books:

1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, Fundamentals of Thermodynamics, John Wiley and Sons.
2. Jones, J. B. and Duggan, R. E., 1996, Engineering Thermodynamics, Prentice-Hall of India
3. Moran, M. J. and Shapiro, H. N., 1999, Fundamentals of Engineering Thermodynamics, John Wiley and Sons.
4. Nag, P.K, 1995, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd

Course code	**PCC-ME-204G**				
Category	Professional Core Courses				
Course title	**Fluid Mechanics**				
Scheme and Credits	L	T	P	**Credits**	Semester-IV
	3	1	0	4	
Objectives:	• To learn about the application of mass and momentum conservation laws for fluid flows • To understand the importance of dimensional analysis • To obtain the velocity and pressure variations in various types of simple flows				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Fluid Properties and Fluid Statics: Concept of fluid and flow, ideal and real fluids, continuum concept, and properties of fluids, Newtonian and non-Newtonian fluids. Pascal's law, hydrostatic equation, hydrostatic forces on plane and curved surfaces, stability of floating and submerged bodies, relative equilibrium, Problems. Fluid Kinematics: Eulerian and Lagrangian description of fluid flow; stream, streak and path lines; types of flows, flow rate and continuity equation, differential equation of continuity in cylindrical and polar coordinates, rotation, vorticity and circulation, stream and potential functions, flow net, Problems.

UNIT-II

Fluid Dynamics: Concept of system and control volume, Euler's equation, Bernoulli's equation, venturimeter, orifices, orificemeter, mouthpieces, kinetic and momentum correction factors, Impulse momentum relationship and its applications, Problems. Compressible Fluid Flow: Introduction, continuity momentum and energy equation, sonic velocity, propagation of elastic waves due to compression of fluid, propagation of elastic waves due to disturbance in fluid, stagnation properties, isentropic flow, effect of area variation on flow properties, isentropic flow through nozzles,diffusers,injectors,Problems..

UNIT-III

Viscous Flow: Flow regimes and Reynolds's number, Relationship between shear stress and pressure gradient, uni-directional flow between stationary and moving parallel plates, movement of piston in a dashpot, power absorbed in bearings. Problems. Flow Through Pipes: Major and minor losses in pipes, Hagen-Poiseuilli law, hydraulic gradient and total energy lines, series and parallel connection of pipes, branched pipes; equivalent pipe, power transmission through pipes, Problems.

UNIT-IV

Boundary Layer Flow: Boundary layer concept, displacement, momentum and energy thickness, von-karman momentum integral equation, laminar and turbulent boundary layer flows, drag on a flat plate, boundary layer separation and control. Streamlined and bluff bodies lift and drag on a cylinder and an airfoil, Problems. Turbulent Flow: Shear stress in turbulent flow, Prandtl mixing length hypothesis, hydraulically smooth and rough pipes, velocity distribution in pipes, friction coefficients for smooth and rough pipes, Problems.

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

1. Expedite the properties of fluid along with pressure measurement techniques and concept of stability.
2. Understand the characteristics of fluid and application of continuity and Bernoulli's equation.
3. Conceptualisation of boundary layer, laminar and turbulent flow.
4. Analyse flows through pipes and open channels.

TEXT BOOKS:

1. Fluid Mechanics – Streeter V L and Wylie E B, Mc Graw Hill
2. Mechanics of Fluids – I H Shames, Mc Graw Hill

REFERENCES BOOKS:

1. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som and G. Biswas, TMH
2. Fluid Mechanics and Fluid Power Engineering – D.S. Kumar, S.K. Kataria and Sons
3. Fluid Mechanics and Machinery – S.K. Agarwal, TMH, New Delhi

Course code	**PCC-ME-206G**				
Category	Professional Core Courses				
Course title	**Strength of Materials**				
Scheme and Credits	L	T	P	**Credits**	Semester-IV
	3	1	0	4	
Objectives:	• To understand the nature of stresses developed in simple geometries such as bars, cantilevers, beams, shafts, cylinders and spheres for various types of simple loads • To calculate the elastic deformation occurring in various simple geometries for different types of loading				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Deformation in solids- Hooke's law, stress and strain- tension, compression and shear stresseselastic constants and their relations- volumetric, linear and shear strains- principal stresses and principal planes- Mohr's circle.

UNIT-II

Beams and types transverse loading on beams- shear force and bend moment diagrams- Types of beam supports, simply supported and over-hanging beams, cantilevers. Theory of bending of beams, bending stress distribution and neutral axis, shear stress distribution, point and distributed loads.

UNIT-III

Moment of inertia about an axis and polar moment of inertia, deflection of a beam using double integration method, computation of slopes and deflection in beams, Maxwell's reciprocal theorems. Columns & Struts: Column under axial load, concept of instability and buckling, slenderness ratio, derivation of Euler's formulae for the elastic buckling load, Eulers, Rankine, Gordom's formulae Johnson's empirical formula for axial loading columns and their applications, eccentric compression of a short strut of rectangular & circular sections, Numerical.

UNIT-IV

Torsion, stresses and deformation in circular and hollow shafts, stepped shafts, deflection of shafts fixed at both ends, stresses and deflection of helical springs.
Axial and hoop stresses in cylinders subjected to internal pressure, deformation of thick and thin cylinders, deformation in spherical shells subjected to internal pressure.

Slope & Deflection: Relationship between bending moment, slope & deflection, Mohr's theorem, moment area method, method of integration, Macaulay's method, calculations for slope and deflection of (i) cantilevers and (ii) simply supported beams with or without overhang under concentrated load, Uniformly distributed loads or combination of concentrated and uniformly distributed loads, Numerical.

Course Outcomes:

1. After completing this course, the students should be able to recognise various types loads applied on machine components of simple geometry and understand the nature of internal stresses that will develop within the components
2. The students will be able to evaluate the strains and deformation that will result due to the elastic stresses developed within the materials for simple types of loading

Text Books:

1. Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India, New Delhi, 2001.
2. R. Subramanian, Strength of Materials, Oxford University Press, 2007.
3. Ferdinand P. Been, Russel Johnson Jr and John J. Dewole, Mechanics of Materials, Tata McGrawHill Publishing Co. Ltd., New Delhi 2005.

Course code	**PCC-ME-208G**				
Category	Professional Core Courses				
Course title	**Materials Engineering**				
Scheme and Credits	L	T	P	**Credits**	Semester-IV
	3	0	0	3	
Objectives:	1. Understanding of the correlation between the internal structure of materials, their mechanical properties and various methods to quantify their mechanical integrity and failure criteria. 2. To provide a detailed interpretation of equilibrium phase diagrams 3. Learning about different phases and heat treatment methods to tailor the properties of Fe-C alloys.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Crystal Structure: Unit cells, Metallic crystal structures, Ceramics. Imperfection in solids: Point, line, interfacial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress.

Mechanical Property measurement: Tensile, compression and torsion tests; Young's modulus, relations between true and engineering stress-strain curves, generalized Hooke's law, yielding and yield strength, ductility, resilience, toughness and elastic recovery; Hardness: Rockwell, Brinell and Vickers and their relation to strength.

UNIT-II

Static failure theories: Ductile and brittle failure mechanisms, Tresca, Von-mises, Maximum normal stress, Mohr-Coulomb and Modified Mohr-Coulomb; Fracture mechanics: Introduction to Stressintensity factor approach and Griffith criterion. Fatigue failure: High cycle fatigue, Stress-life approach, SN curve, endurance and fatigue limits, effects of mean stress using the Modified Goodman diagram; Fracture with fatigue, Introduction to non-destructive testing (NDT)

UNIT-III

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

UNIT-IV

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

Alloying of steel, properties of stainless steel and tool steels, maraging steels- cast irons; grey, white, malleable and spheroidal cast irons- copper and copper alloys; brass, bronze and cupro-nickel; Aluminium and Al-Cu – Mg alloys- Nickel based superalloys and Titanium alloys

Course Outcomes:

1. Student will be able to identify crystal structures for various materials and understand the defects in such structures
2. Understand how to tailor material properties of ferrous and non-ferrous alloys
3.How to quantify mechanical integrity and failure in materials

Text Books:

1. W. D. Callister, 2006, “Materials Science and Engineering-An Introduction”, 6th Edition, Wiley India.
2. Kenneth G. Budinski and Michael K. Budinski, “Engineering Materials”, Prentice Hall of India Private Limited, 4th Indian Reprint, 2002.
3. V. Raghavan, “Material Science and Engineering’, Prentice Hall of India Private Limited, 1999.
4. U. C. Jindal, “Engineering Materials and Metallurgy”, Pearson, 2011.

Course code	**PCC-ME-210G**				
Category	Professional Core Courses				
Course title	**Instrumentation and Control**				
Scheme and Credits	L	T	P	**Credits**	Semester-IV
	3	0	0	3	
Objectives:	1. To provide a basic knowledge about measurement systems and their components 2. To learn about various sensors used for measurement of mechanical quantities 3. To learn about system stability and control 4. To integrate the measurement systems with the process for process monitoring and control				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Measurement systems and performance – accuracy, range, resolution, error sources; Instrumentation system elements – sensors for common engineering measurements; Signal processing and conditioning;

Instruments and Their representation : Introduction, Typical Applications of Instrument Systems, Functional Elements of a Measurement System, Classification of Instruments, Standards and Calibration..

UNIT-II

Transducer Elements : Introduction, Analog and Digital Transducers, Electromechanical; Potentiometric, Inductive Self Generating and Non-Self Generating Types, Electromagnetic, Electrodynamic, Eddy Current,

Magnetostrictive, Variable Inductance, Linearly Variable Differential Transformer, Variable Capacitance, PiezoElectric Transducer and Associated Circuits, Unbonded and Bonded Resistance Strain Gages. Strain Gage Bridge circuits, Single Double and Four Active Arm Bridge Arrangements, Temperature Compensation, Balancing and Calibration, Ionisation Transducers, Mechano Electronic Transducers, Opto-Electrical Transducers, Photo Conductive Transducers, Photo Volatic Transducers, Digital Transducers, Frequency Domain Transducer, Vibrating String Transducer, Binary codes, Digital Encoders.

UNIT-III

Motion, Force and Torque Measurement : Introduction, Relative motion Measuring Devices, Electromechanical, Optical, Photo Electric, Moire-Fringe, Pneumatic, Absolute Motion Devices, Seismic Devices, Spring Mass & Force Balance Type, Calibration, Hydraulic Load Cell, Pneumatic Load Cell, Elastic Force Devices, Separation of Force Components, Electro Mechanical Methods, Strain Gage, Torque Transducer, Toque Meter. Intermediate, Indicating and Recording Elements : Introduction Amplifiers, Mechanical, Hydraulic, Pneumatic, Optical, Electrical Amplifying elements, Compensators, Differentiating and Integrating Elements.

Temperature Measurement : Introduction, Measurement of Temperature, Non Electrical Methods – Solid Rod Thermometer, Bimetallic Thermometer, Liquid-in-Glass thermometer, Pressure Thermometer, Electrical Methods – Electrical Resistance Thermometers, Semiconductor Resistance Sensors (Thermistors), Thermo–Electric Sensors, Thermocouple Materials, Radiation Methods (Pyrometry), Total Radiation Pyrometer, Selective Radiation Pyrometer.

UNIT-IV

Control systems – basic elements, open/closed loop, design of block diagram; control method – P, PI, PID, when to choose what, tuning of controllers; System models, transfer function and system response, frequency response; Nyquist diagrams and their use.
Practical group based project utilizing above concepts.

Pressure and Flow Measurement : Pressure & Flow Measurement, Introduction : Moderate Pressure Measurement, Monometers, Elastic Transducer, Dynamic Effects of Connecting Tubing, High Pressure Transducer, Low Pressure Measurement, Calibration and Testing, Quantity Meters, Positive Displacement Meters, Flow Rate Meters, Variable Head Meters, Variable Area Meters, Rotameters, Pitot-Static Tube Meter, Drag Force Flow Meter, Turbine Flow Meter, Electronic Flow Meter, Electro Magnetic Flow meter. Hot-Wire Anemometer.

Course Outcomes:

Upon completion of this course, the students will be able to understand the measurement of various quantities using instruments, their accuracy & range, and the techniques for controlling devices automatically.

Text Books:

1.Instrumentation and control systems by W. Bolton, 2nd edition, Newnes, 200
2.Thomas G. Beckwith, Roy D. Marangoni, John H. LienhardV , Mechanical Measurements (6th Edition) 6th Edition, Pearson Education India, 2007
3.Gregory K. McMillan, Process/Industrial Instruments and Controls Handbook, Fifth Edition, McGraw-Hill: New York,1999.

Course code	**LC-ME-212G**				
Category	Professional Core Courses				
Course title	**Applied Thermodynamics Lab**				
Scheme and Credits	L	T	P	**Credits**	
	0	0	2	1	
Objectives:	1. To understand Vapour power cycles. 2. To understand steam boilers, their types and components. 3. To learn fundamentals of flow of steam through a nozzle. 4. To understand Steam turbines ,condensers and compressors.				
Class work mark	25 Marks				
Practical mark	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

List of Experiments:

1.To study low pressure boilers and their accessories and mountings.
2. To study high pressure boilers and their accessories and mountings.
3. To prepare heat balance sheet for given boiler.
4. To study the working of impulse and reaction steam turbines.
5. To find dryness fraction of steam by separating and throttling calorimeter.
6. To find power out put & efficiency of a steam turbine.
7. To find the condenser efficiencies.
8. To study and find volumetric efficiency of a reciprocating air compressor.
9. To study cooling tower and find its efficiency.
10. To find calorific value of a sample of fuel using Bomb calorimeter.
11. Calibration of Thermometers and pressure gauges.

Course Outcome (COs): At the end of the course, the student shall have practical exposure of:

1. Vapour power cycles and find and compare different cycles based on their performance parameters and efficiencies.
2. Steam boilers, their types and components.
3. Fundamentals of flow of steam through a nozzle.
4. Steam turbines and can calculate their work done and efficiencies.
5. Types and working of condensers and compressors and define their different types of efficiencies

Note:

1. At least eight experiments should be performed from the above list.

Course code	**LC-ME-214G**				
Category	Professional Core courses				
Course title	**Strength of Materials Lab**				
Scheme and Credits	L	T	P	**Credits**	
	0	0	2	1	
Objectives:	1. To learn the principles of mechanics of solid and various properties of materials. 2. Able to understand the concepts of stress, strain of materials and ability to interpret the data from the experiments.				
Class work mark	25 Marks				
Practical mark	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

List of Experiments:

1. To study the Brinell hardness testing machine & perform the Brinell hardness test.
2. To study the Rockwell hardness testing machine & perform the Rockwell hardness test.
3. To study the Vickers hardness testing machine & perform the Vickers hardness test.
4. To study the Erichsen sheet metal testing machine & perform the Erichsen sheet metal test.
5. To study the Impact testing machine and perform the Impact tests (Izod & Charpy).
6. To study the Universal testing machine and perform the tensile test.
7. To perform compression & bending tests on UTM.
8. To perform the sheer test on UTM.
9. To study the torsion testing machine and perform the torsion test.

Course Outcomes (COs): At the end of the course, the student shall be able to:

1. Learn the principles of mechanics of solid and engineering.
2. Preparation of formal laboratory reports describing the results of experiments.
3. Acquire to operate basic instruments in mechanics of materials lab.
4. Able to understand the concepts of stress, strain of materials and ability to interpret the data from the experiments.

Note:

1. At least Seven experiments are to be performed in the semester.

Course code	**LC-ME-216G**				
Category	Professional Core courses				
Course title	**Fluid Mechanics Lab**				
Scheme and Credits	L	T	P	**Credits**	
	0	0	2	1	
Objectives:	1. Understand the techniques and concept of stability. 2. Learning continuity and Bernoulli's equation. 3. Learn discharge measuring devices and hydraulic coefficients. 4. Knowledge of different types of pipe losses and determine the velocity profile in a pipe.				
Class work mark	25 Marks				
Practical mark	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

List of Experiments:

1. To determine the coefficient of impact for vanes.
2. To determine coefficient of discharge of an orificemeter.
3. To determine the coefficient of discharge of Notch (V and Rectangular types).
4. To determine the friction factor for the pipes.
5. To determine the coefficient of discharge of venturimeter.
6. To determine the coefficient of discharge, contraction & velocity of an orifice.
7. To verify the Bernoullis Theorem.
8. To find critical Reynolds number for a pipe flow.
9. To determine the meta-centric height of a floating body.
10. To determine the minor losses due to sudden enlargement, sudden contraction and bends.
11. To show the velocity and pressure variation with radius in a forced vertex flow.
12. To verify the momentum equation.

Course Outcomes (COs): At the end of the course, the student shall be able to:

1. Understand the techniques and concept of stability.
2. Learning continuity and Bernoulli's equation.
3. Analyse discharge measuring devices and hydraulic coefficients.
4. Knowledge of different types of pipe losses and determine the velocity profile in a pipe.

Note:

1. **At least eight experiments are to be performed in the semester.**

Course code	**LC-ME-218G**				
Category	Professional Core courses				
Course title	**Materials Lab**				
Scheme and Credits	L	T	P	**Credits**	
	0	0	2	1	
Objectives:	1. Learn the principles of materials science and engineering though lab investigation. 2. Understand the basics structure of materials and ability to interpret the data from the experiments.				
Class work mark	25 Marks				
Practical mark	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

List of Experiments:

1. To study crystal structures of a given specimen.
2. To study crystal imperfections in a given specimen.
3. To study microstructures of metals/ alloys.
4. To prepare solidification curve for a given specimen.
5. To study heat treatment processes (hardening and tempering) of steel specimen.
6. To study microstructure of heat-treated steel.
7. To study thermo-setting of plastics.
8. To study the creep behavior of a given specimen.
9. To study the mechanism of chemical corrosion and its protection.
10. To study the properties of various types of plastics.
11. To study Bravais lattices with the help of models.
12. To study crystal structures and crystals imperfections using ball models.

Course Outcomes:

1- Learn the principles of materials science and engineering though lab investigation.

2- Prepare formal laboratory reports describing the results of experiments.

3- Operate basic instruments in materials science and engineering.

4- Understand the basics structure of materials and ability to interpret the data from the experiments.

Note:-

1. **At least eight experiments are to be performed in the semester.**

Course code	**LC-ME-220G**				
Category	Professional Core courses				
Course title	**Instrumentation Lab**				
Scheme and Credits	L	T	P	**Credits**	
	0	0	2	1	
Objectives:	1 - To understand about the applications of measurement systems. 2 - To understand about the basics and working principle of pressure, temperature and flow measurement. 3 - Identify the different variation of measurement parameter with various input conditions. 4 - To analyze the primary, secondary and tertiary measurements. 5 - To learn about the various control devices and parts of measurement systems.				
Class work mark	25 Marks				
Practical mark	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

List of Experiments :

1. To Study various Temperature Measuring Instruments
   (a) Mercury – in glass thermometer
   (b) Thermocouple
2. To study the working of Bourdon Pressure Gauge and to check the calibration of the gauge in a dead-weight pressure gauge calibration set up.
3. To study a Linear Variable Differential Transformer (LVDT) and use it in a simple experimental set up to measure a small displacement.
4. To measure load (tensile/compressive) using load cell on a tutor.
5. To measure torque of a rotating shaft using torsion meter/strain gauge torque transducer.
6. To measure the speed of a motor shaft with the help of non-contact type pick-ups (magnetic or photoelectric).
7. To measure the stress & strain using strain gauges mounted on simply supported beam/cantilever beam.
8. To measure static/dynamic pressure of fluid in pipe/tube using pressure transducer/pressure cell.
9. To test experimental data for Normal Distribution using Chi Square test.
10. Vibration measurement.
11. To study various types of measurement Error.

Course Outcomes:

1 - To understand about the applications of measurement systems.

2 - To understand about the basics and working principle of pressure, temperature and flow measurement.

3 - Identify the different variation of measurement parameter with various input conditions.

4 - To analyze the primary, secondary and tertiary measurements.

5 - To learn about the various control devices and parts of measurement systems

Note:

1. **At least eight experiments are to be performed in the Semester.**

MC-106G : (ENVIRONMENT SCIENCE)

Theory 75 Marks Field Work 25 Marks (Practical/Field visit)

Unit-1 The Multidisciplinary nature of environment studies. Definition, scope and importance. (2 lecture)

Unit-2 Natural Resources :

Renewable and non-renewable resources :

Natural resources and associated problems.

a) Forest resources : Use and over-exploitation : deforestation, case studies. Timber extraction, mining dams and their effects on forests and tribal people.

b) Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

c) Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources : World food problems, changes, caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, Water logging, salinity, case studies.

e) Energy resources : Growing energy needs; renewable and non-renewable energy sources, use of alternate energy sources, case studies.

f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

* Role of an individual in conservation of natural resources.

* Equitable use of resources for sustainable lifestyles.

(8 lectures)

Unit-3 Ecosystems :

* Producers, consumers and decomposers.

* Energy flow in the ecosystem.

* Ecological succession.

* Food chains, food webs and ecological pyramids.

* Introduction, types, characteristic features, structure and function of the following eco-system :

a. Forest ecosystem.

b. Grassland ecosystem.

c. Desert ecosystem.

d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) (6 lectures)

Unit-4 Biodiversity and its conservation

* Introduction - Definition : Genetic, Species and ecosystem diversity.

* Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.

* Biodiversity at global, National and local levels.

* India as a mega-diversity nation.

* Hot-spots of biodiversity.

* Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.

* Endangered and endemic species of India.

* Conservation of biodiversity : In-situ and ex-situ conservation of biodiversity.

(8 lectures)

Unit-5 Environmental pollution :

Definition, causes, effects and control measures of :

a) Air pollution.

b) Water pollution

c) Soil pollution

d) Marine pollution

e) Noise pollution

f) Thermal pollution

g) Nuclear hazards

* Solids waste management: causes, effects and control measures of urban and industrial wastes.
* Role of an individual in prevention of pollution.
* Pollution case studies.
* Disaster management : floods, earthquake, cyclone and landslides.

(8 lectures)

Unit-6 Social issues and the Environment:

* From unsustainable to sustainable development.
* Urban problems related to energy.
* Water conservation, rain water harvesting, watershed management.
* Resettlement and rehabilitation of people : its problems and concerns case studies.
* Environmental ethics : Issues and possible solutions.
* Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
* Wasteland reclamation.
* Consumerism and waste products.
* Environment Protection Act.
* Air (Prevention and Control of pollution) Act.
* Water (Prevention and Control of pollution) Act.
* Wildlife Protection Act.
* Forest Conservation Act.
* Issues involved in enforcement of environmental legislation.
* Public awareness. (7 lectures)

Unit-7 Human population and the Environment.

Population growth, variation among nations.

Population explosion- Family Welfare Programme.

Environment and human health.

Human Rights.

Value Education.

HIV/AIDS.

Woman and Child Welfare

Role of Information Technology in Environment and human health.

Case Studies. (6 lectures)

Unit-8 Field Work :

* Visit to a local area to document environmental assets - river/forest/grassland/hill/mountain.
* Visit to a local polluted site-urban/Rural/ Industrial/ Agricultural.
* Study of common plants, insects, birds.
* Study of simple ecosystems- pond, river, hill slopes, etc. (Field work equal to 10 lecture hours).

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(M) Magazine

(R) Reference

(TB) Textbook

The scheme of the paper will be under :

The subject of Environmental Studies will be included as a qualifying paper in all UG Courses and the students will be required to qualify the same otherwise the final result will not be declared and degree will not be awarded.

The duration of the course will be 40 lectures. The examination will be conducted along with the semester examinations.

Exam. Pattern : In case of awarding the marks, the paper will carry 100 marks. Theory: 75 marks, Practical/ Field visit : 25 marks. The structure of the question paper will be :

Part- A: Short Answer Pattern	:	15marks
Part- B : EssayType with inbuilt choice	:	60marks
Part-C : Field Work (Practical)	:	25marks

Instructions for Examiners :

Part- A : Question No. 1 is compulsory and will contain five short- answer type question of 3 marks each covering the entire syllabus.

Part-B : Eight essay type questions (with inbuilt choice) will be set from the entire syllabus and the candidate will be required to answer any four of them. Each essay type question will be of 15 marks.

The examination of the regular students will be conducted by the concerned college/Institute. Each student will be required to score minimum 40% marks separately in theory and practical/Field visit. The marks in this qualifying paper will not be included in determining the percentage of marks obtained for the award of degree. However, these marks will be shown in the detailed marks certificate of the students.