Gondwana University, Gadchiroli

Four Year Degree Course in Engineering and Technology

Course and Examination Scheme with Model AICTE Curriculum of Bachelor of Engineering (Mechanical Engineering)

Third (III) Semester of Mechanical Engineering

Course Category	Course code	BoS	Subject	Teaching Scheme				Examination Scheme									
				House per week				THEORY						PRACTICAL			
				L	T	P	No. of Credits	Duration of Paper (Hrs)	Max MarkS	Max Marks		Total	Min Passing Marks	Max. Marks	Max. Marks	Total	Min Passing Marks
										Sessional							
									ESE	MSE	IE			TW	POE		
Basic Science Course	BSC-202	S&H	Mathematics III (PDE, Probability & Statistics)	3	1	0	4	3	80	10	10	100	40	_	_	_	_
Engineering Science Course	ESC-202	S&H	Engineering Mechanics	3	0	0	3	3	80	10	10	100	40	_	_	_	_
Professional Core Course	PCC-ME201	Mechanical	Thermodynamics	3	1	0	4	3	80	10	10	100	40	_	_	_	_
Professional Core Course	PCC-ME 205	Mechanical	Material Engineering	3	0	0	3	4	80	10	10	100	40	_	_	_	_
Professional Core Course	PCC-ME208	Mechanical	Fluid Mechanics	3	1	0	4	4	80	10	10	100	40	_	_	_	_
Laboratory																	
Engineering Science Course	ESC-202P	S&H	Engineering Mechanics	0	0	2	1	_	_	_	_	_	_	25	25	50	25
Professional Core Course	PCC-ME 205P	Mechanical	Material Engineering	0	0	2	1	_	_	_	_	_	_	25	25	50	25
Professional Core Course	PCC-ME207	Mechanical	Machine Drawing	0	1	2	3	_	_	_	_	_	_	50	50	100	50
		Total		15	4	6	23		400	50	50	500		100	100	200	_
		Semester Total		25			23	700									

Semester III (Second Year)

Branch /Course Mechanical Engineering

S1. No.	Category	Code	Course Title	Hours per week			Total contact hours	Credits
				Lecture	Tutorial	Practical		
1.	Basic Science Course	BSC-202	Mathematics III (PDE, Probability & Statistics)	3	1	0	4	4
2.	Engineering Science Course	ESC-202	Engineering Mechanics	3	0	2	5	4
3.	Professional Core Course	PCC-ME201	Thermodynamics	3	1	0	4	4
4.	Professional Core Course	PCC-ME 205	Material Engineering	3	0	2	5	4
5.	Professional Core Course	PCC-ME208	Fluid Mechanics	3	1	0	4	4
6.	Professional Core Course	PCC-ME207	Machine Drawing	0	1	2	4	3
			Total Credits					23

BSC-202	Mathematics III (PDE, Probability & Statistics)	3L :1T :0P	4 Credits

Teaching Scheme
Lectures: 3 Hours/Week
Tutorial: 1Hour/Week

Examination Scheme
Duration of Paper: 03 Hours
University Assessment: 80 Marks
Marks College Assessment: 20 Marks

COURSE OUTCOMES:

CO1:-Apply knowledge of partial differential equations and complex number to model/solve Engineering problems

CO2:- Apply the concept of probability to find physical significance of various distribution phenomena

CO3:- Calculate rank of matrix, characteristic equation and roots and find inverse of a matrix

CO4:- Expand periodic functions as Fourier series and Solve partial differential equation with given boundary condition using Laplace transform

CO5:- Calculate approximate values of derivatives and integrals using numerical techniques

SYLLABUS:

UNIT1: Partial Differential Equations & Complex Numbers (9 Hrs)

Partial Differential Equations with Lagrange's form, Linear Homogeneous equation of higher order with constant coefficient, Methods of separation of variables, Application to 1D heat flow

Complex Numbers:-Analytical functions, Cauchy Riemann conditions, conjugate functions, singularities, Cauchy's integral theorem and formula (Statement Only), Laurent's theorem (Statement Only), residue theorem (Statement only)

UNIT2: Random Variables and Probability Distribution (9 Hrs)

Random variables distribution functions for discrete and random variables, Joint distribution, Mathematical Expectations, Moments and Moments Generating function, Characteristic function, Coefficient of skewness and Kurtosis.

UNIT3: Matrices (9 Hrs.)

Inverse, rank of matrix, characteristic equation, Eigen values and Eigen vectors, Reduction to diagonal form, Cayley-Hamilton theorem, Sylvestor theorem, solution of second order differential equation with constant coefficient by matrix method, Reduction of quadratic form to canonical form.

UNIT4: Fourier series, Fourier Transform and Laplace Transform (9 Hrs.)

Periodic function and their Fourier series expansions, Fourier series for Odd and even function,

Change of Interval, half range expansion, Fourier integrals and Fourier Transform.

Laplace Transform:- Definition, properties (Statements only), periodic function and unit step functions, Inverse Laplace transform by partial fraction method and convolution theorem, solution of ordinary linear differential equation with constant coefficient by Laplace transform.

UNIT5: Numerical Methods: (9 Hrs)

Solution of algebraic and transcendental equation by False position method and Newton raphson methods, solution of system by simultaneous linear equation by Gauss Jordan Method, Gauss seidal method, Crouts Method, Milne predictors method, Rung -Kutta method for 4th order method.

TEXTBOOKS:-

1. Higher Engineering Mathematics, B. S. Grewal
2. Higher Engineering Mathematics, H. K. Das
3. Theory and problems of probability and statistics, Schaum Series, M.R. Spiegal (MGH)
4. Introductory methods of numerical analysis, S. S. Sastri

REFERENCE BOOKS:-

1. Advanced Engineering Mathematics, Kreyszig
2. Mathematics for Engineers, Chandrika Prasad
3. Advanced Mathematics for Engineers, Chandrika Prasad
4. Applied Mathematics for Engineering & Physics, L.A. Pipes & Harvile

ESC 202	ENGINNERING MECHANICS (Theory)	3L :0T :0P	3 Credits

Teaching Scheme	Examination Scheme
Lectures: 3 Hours/Week	Duration of Paper: 03 Hours
Tutorial: 0 Hour/Week	University Assessment: 80 Marks
	Marks College Assessment: 20 Marks

COURSE OUTCOMES:

CO1:- Determine resultant of force and moments for a given system of forces

CO2: Analyse planer and spatial systems to determine forces in members of trusses frames and problems related to friction

CO3: Determine centroid and second moment of area and law of machine for various simple machines

CO4: Calculate motion characteristics of body subjected to a given force system

CO5: Apply Newton's law and conservation laws to elastic collisions and motion of rigid bodies

SYLLABUS:

UNIT 1:- **(9 Hrs]**

Basic principles of mechanics, Types of force system, Moment of a force about a point and about an axis, Couple, Equivalent force systems: Resultant of a co-planner and spatial force system. Analytical and graphical methods. Equilibrium of co-planner force system. Applications to beams and frames

UNIT 2:- **(9 Hrs)**

Analysis of Truss. Theory and Laws of friction and its application like Cone friction wedges, belt friction and band brakes.

UNIT 3:- **(9 Hrs)**

Centroid of composite areas, Moment of inertia and products of inertia of plane areas, Transfer theorems for moment of inertia and Product of inertia. Mhor's circle method.

Simple Machine: Differential wheel and axle, single and double purchase Crab, Velocity Ratio, Mechanical advantage, efficiency etc.

UNIT 4:- **(9 Hrs)**

Kinematics of Particles: rectilinear motion, curvilinear motion in Cartesian and polar co-ordinates, Motion of projectiles, Relative motion, Fixed axis rotation.

UNIT 5 :- **(9 Hrs)**

Kinetics of particles: D'alembert's principle, equations of motion of particles and rigid bodies. Motion of connected bodies.

Principal of work and energy, Principal of Impulse Momentum and their applications to

particles. Direct central Impact.

TEXT BOOKS:

1. Engineering Mechanics: F. L. Singer
2. Engineering Mechanics: Timoshenko & Young
3. Engineering Mechanics: Bear & Jonston
4. Engineering Mechanics: I. H. Shames
5. Engineering Mechanics: A. Nelson

ESC-202P	**ENGINEERING MECHANICS** (Practical)	**0L :0T :2P**	**1 Credits**

Teaching Scheme	**Examination Scheme**
Lectures: 2 Hours/Week	University Assessment: 25 Marks
	Marks College Assessment: 25 Marks

LIST OF PRACTICAL :

1. Study of simple lifting machines
2. Determination mechanical advantage, velocity ratio and efficiency of Differential axel and wheel and verification of law of machine.
3. Determination mechanical advantage, velocity ratio and efficiency of single purchase crab winch and verification of law of machine.
4. Determination mechanical advantage, velocity ratio and efficiency of double purchase crab winch and verification of law of machine.
5. Determination mechanical advantage, velocity ratio and efficiency of worm and worm wheel and verification of law of machine.
6. Determination mechanical advantage, velocity ratio and efficiency of simple screw jack and verification of law of machine.
7. Determination of tensile and compressive forces in Jib-Crane apparatus and verification of Law of triangle.
8. Determination of reactions at the support of simply supported beam.
9. Determination of limiting friction, angle of friction and coefficient of friction between two bodies in contact by friction plane apparatus.
10. Determination of belt or coil friction between two bodies in contact by coil friction apparatus.
11. Determination of mass moment of inertia of Fly Wheel.

12. Determination of value of “acceleration due to gravity” and verification of Newton’s Second law of Motion by Fleture’s trolly equipment.

13. Graphical Methods:

a. Determination of resultant.

b. Determination of support reactions.

c. Determination of forces in the members of truss by Maxwell’s Diagram Method.

d. Determination of frictional forces.

A Journal/Report on experiments conducted shall be submitted by each student. University Practical examination shall be on viva-voce of 10 marks and practical performance or objective test of 15 marks.

PCC ME 201	THERMODYNAMICS (Theory)	3L :1T :0P	4 Credits

Teaching Scheme
Lectures: 3 Hours/Week
Tutorial: 1Hour/Week

Examination Scheme
Duration of Paper: 03 Hours
University Assessment: 80 Marks
Marks College Assessment: 20 Marks

COURSE OUTCOMES:

CO1:- Apply the concepts of thermodynamic system, control volume, thermodynamic properties, thermodynamic equilibrium, work and heat for various applications

CO2:- Apply the first law of thermodynamics to the closed and open systems.

CO3:- Apply the first law of thermodynamics to steady flow processes.

CO4:- Analyze heat engines, refrigerators and heat pumps by applying the second law of thermodynamics.

CO5:- Evaluate properties of wet, dry saturated and superheated steam in the thermodynamic process for various applications.

SYLLABUS:

UNIT–I **[9 Hrs.]**

Introduction to Thermodynamics :- Basic concepts of Thermodynamics, Thermodynamics Systems, Properties of system, State & Equilibrium, Processes & Cycles, Quasi-static Process, Thermodynamic Equilibrium, Temperature &Zeroth Law of Thermodynamics. Work Transfer, Mechanical forms of work, Non-Mechanical forms work (Electrical, Shaft, Magnetic etc.) Heat Transfer, The Ideal Gas equation of state, Difference between Gas & Vapor, Compressibility factor, Avagadro's Hypothesis, Universal Gas Constant, Internal energy & specific heats of gases.

UNIT-II **[9 Hrs.]**

First Law of Thermodynamics :- Closed Systems (Control mass system) undergoing a cycle and change of state, Energy, Different forms of Energy, PMM-I, Work done, Change in internal energy, Heat transferred during various thermodynamic processes, P-V diagrams.

UNIT-III **[9 Hrs.]**

Application of First Law to Steady Flow, (Control volume systems), Thermodynamic analysis of control volumes, Conservation of energy principle, Flow work & enthalpy, The steady flow process applied to i) Nozzles & Diffusers ii) Turbine & Compressors iii) Throttle Valves, iv) Pump, Boiler, etc.

UNIT-IV **[9 Hrs.]**

Second Law of Thermodynamics :- Introduction (Law of degradation of energy), Thermal energy reservoirs, Heat engines, Refrigerator & Heat pump, Kelvin-Plank &Clausius statements, Perpetual motion machine-II, Reversible & Irreversible processes, Carnot cycle, Carnot Theorem, Thermodynamic temperature scale.
Entropy: - The Clausius inequality, Entropy, Principle of increase of entropy, Change in entropy for Closed & Steady flow open systems. T-S diagrams..

UNIT-V **[9 Hrs.]**

PROPERTIES OF STEAM :- Formation of steam, Sensible heat, Latent heat, Super heat, Wet steam, Dryness fraction, Critical state, Internal energy of steam, External work done during evaporation, T-S diagram, Mollier chart, Work & Heat transfer during various thermodynamics processes with steam as working fluid. Determination of dryness fraction using various calorimeters.

TEXT BOOKS:

1. Engineering Thermodynamics, P.K. Nag
2. Thermodynamics - An engineering approach, YunusCengal, M.A.Boles, Tata Mc-Graw Hill Publication
3. Fundamentals of classical Thermodynamics, GordenJ.V.Wylen, Sonntag
4. Basic Engineering Thermodynamics, ReinerJoel.
5. Fundamentals of engineering Thermodynamics, E. Rathakrishan,PHI

PCC-ME 205	**MATERIALS ENGINEERING** (Theory)	3L :1T :0P	4 Credits

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hours/Week	Duration of Paper: 03 Hours
Tutorial: 1Hour/Week	University Assessment: 80 Marks
	Marks College Assessment: 20 Marks

COURSE OUTCOMES:

CO1:- Student will be able to identify crystal structures for various materials and understand the defects in such structures

CO2;- Understand how to tailor material properties of ferrous and non-ferrous alloys

CO3:- How to quantify mechanical integrity and failure in materials

CO4;- Student will able to correlate mechanical properties with microstructures

CO5:- Understand the effect of heat treatment on mechanical and micro-structural properties of Metals

SYLLABUS:

- Introduction to Crystal systems in Metals. Bravais Lattice. Crystal Structure: Unit cells, Metallic crystal structures, Ceramics. Miller Indices for planes and directions. Imperfection in solids: Point, line, interfacial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress. **(6 hours)**

- 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. Introduction to nondestructive testing (NDT) Static failure theories: Ductile and brittle failure mechanisms. Fracture mechanics: Introduction to Stress-intensity factor approach and Griffith criterion**(8 hours)**

- Introduction to Engineering Materials: Classification of Engineering materials , Material selection in mechanical design, Engineering materials and their properties, Basics of materials selection, the design process, material selection charts, Materials-process selection charts. Materials for high temperature application. High temperature alloys for power plant and nuclear applications. Classification,properties, application of composite, polymers, plastics and elastomers.**(6 hours)**

- Phase diagrams :Alloys, substitutional and interstitial solid solutions- Phase diagrams with reactions involve in it: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions.Precipitation hardenable

steels. Solidification of pure metals and alloys. Gibb's phase and lever rule application in phase diagrams**(6 hours)**

- Introduction to steels and cast irons :Iron Iron-carbide phase diagram and microstrctural aspects of ledeburite, austenite, ferrite and cementite, cast iron. Heat treatment of Steel AND CAST IRONS: 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 **(6 hours)**

- Commercial Ferrous and non-ferrous alloys: 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(Al-Mg-Si,Al-Si, Modified form of Al-Si or LM series alloys) , designated system in Al-alloys. Nickel based superalloys and Titanium alloys.**(8 hours)**

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.

4. Jastrezebski Z.D., The nature and properties of engineering Materials, Wiley Newyork.

5. Aver S.H, Introduction to Physical Metallurgy, McGraw Hill,Tokyo.

PCC-ME 205P	**MATERIALS ENGINEERING** (Practical)	**0L :0T :2P**	**1 Credit**

Teaching Scheme	**Examination Scheme**
Lectures: 2 Hours/Week	University Assessment: 25 Marks
	Marks College Assessment: 25 Marks

LIST OF PRACTICAL :

1. To study different crystal systems in Metals
2. To study cooling curve of a binary alloy.
3. Determination of the elastic modulus and ultimate strength of a given Materials
4. Determination of hardness number for given metallic specimen
5. Study of metallurgical Microscope

6. To study specimen preparation for metallography

7. To measure grain size and study the effect of grain size on hardness of the given metallic specimens.

8. To Study & drawing of microstructure of plain carbon steel

9. Effect of annealing & normalizing on microstructure & hardness of steel

10. Metallography of cast iron and non-ferrous metals

A Journal/Report on experiments conducted shall be submitted by each student. University Practical examination shall be on viva-voce of 10 marks and practical performance or objective test of 15 marks.

PCC-ME208	FLUID MECHANICS (Theory)	3L :1T :0P	4 Credits

Teaching Scheme
Lectures: 3 Hours/Week
Tutorial: 1Hour/Week

Examination Scheme
Duration of Paper: 03 Hours
University Assessment: 80 Marks
Marks College Assessment: 20 Marks

COURSE OUTCOMES:

CO1:- Acquaint with fluid properties and evaluate pressure distributions in a static fluid, taking account of hydrostatic pressure, buoyancy force.

CO2:- Acquaint with Kinematics and Dynamics of fluid flow.

CO3:- Acquaint with methods for measurement of fluid flow.

CO4:- Analyze the head loss in pipes for both minor and major losses.

CO5:- Understand Dimensional Analysis and Boundary Layer Concept .

SYLLABUS:

UNIT–I **[9 Hrs.]**

Introduction to Fluid Mechanics: - Properties of fluids, Types of fluids, Newton's law of viscosity & its applications, Surface tension &capillarity.Pascal's law, Hydrostatic law, Fluid pressure & its measurements (simple & Differential Manometers)

Hydrostatics: - Pressure variations in compressible & incompressible fluids, Forces on submerged plane surfaces & curved surfaces.

UNIT–II **[9Hrs.]**

Buoyancy, centre of Buoyancy, Metacentre, Metacentric height, Stability of floating and submergedbodies.

Kinematics of fluid flow:- Types of flow, Pathline, stream line, stream tube streak line, Continuity equation, Velocity Potential function & Stream function.

Dynamics of fluid flow: - Euler's equation of motion, Derivation of Bernoulli's equation for incompressible flow.

UNIT–III **[9Hrs.]**

Measurement of Fluid Flow: - Through ducts: Venturimeter, Through Reserviors: Large Orifice & through open channels: Discharge over triangular, Rectangular & Trapezoidal notch

Viscous Flow:- Flow of Viscous fluid through circular pipe, Flow of viscous fluid between two parallel plates, Kinetic energy Correction factor & Momentum Correction factor.

UNIT–IV **[9Hrs.]**

Turbulent flow: - Reynold's experiment, frictional loss in pipe flow.

Flow through pipes:- Equations of pipe flow, Losses in pipes & fittings, Hydraulic Gradient Line & Total energy Line, Syphon, Flow through pipe in series and parallel, Flow through branched pipes, Power transmission through pipe, Flow through nozzle, Water Hammer.

UNIT–V **[9 Hrs.]**

Dimensional Analysis: - Dimensional Homogeneity, Rayleigh's method, Buckingham's π-Theorem.

Boundary Layer flow:- Boundary Layer concepts, Boundary Layer thickness, Displacement thickness, Momentum thickness, energy thickness, Momentum Integral equation for boundary layer (Von Karman), Separation, Drag and Lift on immersed bodies.

TEXT BOOKS:

1. Fluid Mechanics & hydraulic Machines - Dr. V.M.Domkundwar

2. Fluid Mechanics & Fluid Power Engineering -D.S.Kumar

3. Fluid Mechanics & hydraulic Machines - R.K.Bansal

PCC-ME207	MACHINE DRAWING (Practical)	0L :1T :2P	3 Credits

Teaching Scheme
Tutorial: 1Hour/Week
Practical : 2 Hours/Week

Examination Scheme
University Assessment: 50 Marks
Marks College Assessment: 50Marks

Course Outcomes:

CO1:- Interpret material symbols and welding symbols used in machine drawing as per BIS codes

CO2:-Construct orthographic and sectional views of standard machine components like keys, couplings, cotters, riveted and bolted joints

CO3:- Specify machine components like bolts, nuts and washers for machines

CO4:- Assemble various machine parts by interpreting its part drawings

CO5:- Analyze process sheet and production drawing of a machine component.

SYLLABUS:

Unit I -Drawing Standards for following: Drawing Sheets, Name Blocks, Lines, Sections, Dimensioning, Dimensioning of Tolerances Standard Components, Standard Features, Machining Symbols, Welding Symbols, Surface Finish Symbols, Heat Treatment, Manufacturing Instructions, Allowances, Materials.

Unit II - Orthographic Projections of Elements Orthographic Projections, Sectional Views, Multiple Views, Missing Views, Profiles, Cross sections, References, Alignments, Dimensioning.

Unit III - Study, qualitative selection of type / size (excluding design calculations) and standard practices for the following elements Threads, Bolts, Nuts, Washers, Rivets, Welds, Keys & Keyways, Splines, Couplings. Assembly and Dismantling Techniques,3-D Drawing of component using software like CATIA

Unit IV - Principles of Assembly: Fits and Tolerances (Standard, types, application and selection) Tolerance Charting Surface Finish requirement for assembly, Manufacturing Method, Geometrics suitable for assembly, Assembly/Dismantling Tools, Bearing Assemblies, Assemblies by fastening.

Unit V- Assembly Drawings (Principles, techniques and standards of drawing of following) Component, Subassembly, Full assembly, Exploded Views, Various frames / brackets / housings / casings, Study of some standard assemblies. Production Drawing: Name Plates, Part List, Revisions, etc., Essential Parts/Formats required for production drawing, Process Sheet,

TEXTBOOKS

1. Narayana K.L. Kannaiah R., Venkata Reddy K, "Machine Drawing," New Age Int. Pub.
2. Narayana K.L. Kannaiah R., Venkata Reddy K, "Production Drawing," New Age Int. Pub.
3. N. D. Bhatt,' Machine Drawing," Charotar Publishing House.
4. PSG College of Technology," Design Data Book,"DPV Printers, Coimbature
5. Engineering Drawing Practice for School & Colleges,"Bureau of Indian Standards
6. Fundamentals of Machine Drawing, Sadhu Singh, P. L.Sah, PHI Learning Pvt. Ltd.

LIST OF PRACTICAL :

1. Various Drawing standards:1 sheet
2. Pencil Drawings of some standard components: Two sheets.
3. Pencil Drawings of standard assemblies with components: 2 sheets (2 different assemblies)
4. Pencil Drawings of mechanical components in Orthographic view: Two sheet.
5. Computer printout of a small component in 3D:1 sheet.
6. Computer printout of a assembly with component drawings in 3-D: One Assembly.
7. Computers print out of Production Drawing and Process sheets for two components.

Note:-

1. Pencil drawings shall be in Full Imperial Sheet. Computer print outs shall be on Laser printer in A3 size.
2. During university examination of 50 marks, students are expected to solve TWO problems of 30 marks of TWO hrs duration on
   - Sectional View / Missing view
   - Assembly drawing / sub assembly drawing
   - Prepare and explain production drawing

   Oral/ Viva-Voce of 20 marks shall be conducted during University Practical Examination

Gondwana University, Gadchiroli

Four Year Degree Course in Engineering and Technology

Course and Examination Scheme with Model AICTE Curriculum of Bachelor of Engineering (Mechanical Engineering)

Fourth (IV) Semester of Mechanical Engineering

Course Category	Course code	BoS	Subject	Teaching Scheme				Examination Scheme									
				House per week			No. of Credits	THEORY						PRACTICAL			
				L	T	P		Duration of Paper (Hrs)	Max MarkS	Max Marks Sessional		Total	Min Passing Marks	Max. Marks	Max. Marks	Total	Min Passing Marks
									ESE	MSE	IE			TW	POE		
Engineering Science Course	ESC-201	Electronics	Basic Electronics Engineering	3	1	0	4	3	80	10	10	100	40	–	–	–	–
Professional Core Course	PCC-ME202	Mechanical	Applied Thermodynamics	3	1	0	4	3	80	10	10	100	40	–	–	–	–
Professional Core Course	PCC-ME203	Mechanical	Fluid Machines	3	0	0	3	3	80	10	10	100	40	–	–	–	–
Professional Core Course	PCC-ME204	Mechanical	Strength of Materials	3	0	0	3	4	80	10	10	100	40	–	–	–	–
Professional Core Course	PCC-ME206	Mechanical	Instrumentation and Control	3	1	0	4	4	80	10	10	100	40	–	–	–	–
Mandatory Courses	MC-02	S&H	Environmental Science	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Laboratory																	
Professional Core Course	PCC-ME203P	Mechanical	Fluid Machines	0	0	2	1	–	–	–	–	–	–	25	25	50	25
Professional Core Course	PCC-ME204P	Mechanical	Strength of Materials	0	0	2	1	–	–	–	–	–	–	25	25	50	25
		Total		15	3	4	20		400	50	50	500		50	50	100	_
		Semester Total		22			20	600									

Semester IV (Second Year)

Branch /Course Mechanical Engineering

S.N.	Category	Code	Course Title	Hours per week			Total contact hours	Credits
				Lecture	Tutorial	Practical		
1	Engineering Science Course	ESC-201	Basic Electronics Engineering	3	1	0	4	4
2	Professional Core Course	PCC-ME202	Applied Thermodynamics	3	1	0	4	4
3	Professional Core Course	PCC-ME203	Fluid Machines	3	0	2	5	4
4	Professional Core Course	PCC-ME204	Strength of Materials	3	0	2	5	4
5	Professional Core Course	PCC-ME206	Instrumentation and Control	3	1	0	4	4
6	Mandatory Courses	MC-02	Environmental Science	--	--	--	0	0
			Total Credits					20

ESC 201	BASIC ELECTRONIC ENGINEERING	3L:1T:0P	4 credits

Teaching Scheme
Lectures: 3 Hours/Week
Tutorial: 1Hour/Week

Examination Scheme
Duration of Paper: 03 Hours
University Assessment: 80 Marks
College Assessment : 20 Marks

COURSE OUTCOMES:

CO1: Understand the principles of semiconductor devices and their applications.

CO2: Design an application using Operational amplifier.

CO3: Understand the working of timing circuits and oscillators.

CO4: Understand logic gates, flip flop as a building block of digital systems.

CO5: Learn the basics of Electronic communication system

SYLLABUS:

Unit I - **[9 Hrs.]**

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 – **[9 Hrs.]**

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 – **[9 Hrs.]**

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 – **[9 Hrs.]**

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

Unit V- **[9 Hrs.]**

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

TEXTBOOKS

1. Floyd ," Electronic Devices" Pearson Education 9th edition, 2012.

2. R.P. Jain , "Modern Digital Electronics", Tata McGraw Hill, 3rd Edition, 2007.

3. Frenzel, "Communication Electronics: Principles and Applications", Tata McGraw Hill, 3rd Edition, 2001

PCCME202	APPLIED THERMODYNAMICS (Theory)	3L:1T:0P	4 credits

Teaching Scheme
Lectures: 3 Hours/Week
Tutorial: 1Hour/Week

Examination Scheme
Duration of Paper: 03 Hours
University Assessment: 80 Marks
College Assessment : 20 Marks

COURSE OUTCOMES:

CO1:- Analyze air standard cycles applied in prime movers and Rankinevapour cycle.

CO2:- Acquaint with fuels for steam generators and types of steam generators.

CO3:- Analyze flow through steam nozzles.

CO4:- Analyze performance of steam turbines.

CO5:- Acquaint with steam condensers and cooling towers.

SYLLABUS:

UNIT–I **[9 Hrs.]**

Air Standard Cycles :- Otto cycle, Diesel cycle, Dual cycle, Stirling& Ericsson cycle, Brayton cycle (Thermal efficiencies and mean effective pressure) Vapour cycles :- Rankine cycle (work done and efficiency, specific steamconsumption),Vapor compression refrigeration cycles, refrigerants and their properties.

UNIT – II **[9 Hrs.]**

Introduction to layout of thermal power plant, principle of steam generation, fuel for steam generators, classification of steam generators, fire tube and water tube boilers, high pressure boilers, boiler mountings and accessories.

UNIT – III **[9 Hrs.]**

Steam nozzles: Adiabatic expansion in nozzles, maximum discharge, critical pressure ratio and effects of friction, calculation of throat and exit areas, supersaturated flow, Wilson Line.

Steam turbines: Working principle of steam turbines, classification of steam turbines, comparison of impulse and reaction turbines, compounding of steam turbines, governing of turbines.

UNIT – IV **[9 Hrs.]**

Steam turbines: Energy losses in steam turbines, flow of steam through turbine blades, reheat factors, velocity diagrams, graphical and analytical methods, work done, thrust and power, dimensions and proportioning of the blades, steam turbine efficiencies, condition for maximum efficiencies, reheat and regenerative cycles.

UNIT-V **[9 Hrs.]**

Steam condensers: Types of condensers, classification of condensers, quality and quantity of cooling water required, calculations for surface condenser, Dalton's law of partial pressure, sources of air

leakages and air removal, air ejectors.

Cooling towers: wet cooling towers, dry cooling towers, cooling ponds.

TEXTBOOKS

1. Thermal Engineering, P.L. Ballaney, Khanna Publications.

2. A Course in Power Plant Engineering, Arora& V.M. Domkundwar, DhanpatRai& Sons

3. Thermal Engineering, R. K. Rajput, Laxmi publications.

4. Thermal Engineering, M.M. Rathode, TMH publication.

5.A Course in Thermal Engineering, AnandDomkundwar, C.P. Kothandaraman, S. Domkundwar, DhanpatRai& Sons.

6.Engineering Thermodynamics,P.K.Nag

PCC-ME 203	FLUID MACHINES (Theory)	3L :0T :0P	3 Credits

Teaching Scheme
Lectures: 3 Hours/Week
Tutorial: 1Hour/Week

Examination Scheme
Duration of Paper: 03 Hours
University Assessment: 80 Marks
College Assessment : 20 Marks

COURSE OUTCOMES:

1. Apply momentum principle for impact of jet on blades/vanes
2. Evaluate the performance of pumps and turbines.
3. Analyze positive displacement pump with indicator diagram considering acceleration and velocity
4. Conduct model testing of Pumps and turbines and Understand the working, operation and construction of various water lifting devices

SYLLABUS:

UNIT I: IMPACT OF JETS & IMPULSE TURBINE [9 Hrs.]

Impulse Momentum Principle, Dynamic Action of Jets on Fixed and Moving Flat Plates and Curved Vanes.Velocity Triangles, Introduction to Jet Propulsion of Ships.

Theory of Turbo machinery, Euler's Equation, Classification of Hydraulic Machines.Elements of Hydroelectric Power Plant.

Pelton Turbines: Principle, Constructional Features, Velocity Diagrams and Analysis, Working Proportions, Design Parameters, Cavitation in Turbines, Governing.

UNIT II: REACTION TURBINE [9 Hrs.]

Francis & Kaplan Turbines: Principle of Operation, Comparison with Pelton Turbines. Constructional Features, Velocity Diagrams and Analysis, Working Proportions, Design Parameters, Performance Characteristics, Selection Criterion and Governing.Draft Tube Theory,

UNIT III: NON POSITIVE DISPLACEMENT PUMPS [9 Hrs.]

Hydraulic Pumps:- Classification and their applications, Centrifugal Pumps Operation, Priming, Fundamental Equation, Various Heads, Velocity Triangles and Analysis, slip Factor, Vane Shape, Losses and Efficiencies, Multi staging of Pumps, Design Consideration, Working Principle, N.P.S.H., Cavitation, Performance Characteristics.

UNIT IV; POSITIVE DISPLACEMENT PUMPS [9 Hrs.]

Reciprocating Pumps: Types, Main Components, Slip, Work done, Theoretical and Actual Indicator Diagrams. Air Vessels (introduction), Cavitation

Rotary Pumps: Introduction to Gear Pumps, Sliding Vane Pumps, Screw Pumps.

UNIT V: MODEL TESTING & WATER LIFTING DEVICES [9 Hrs.]

Model Testing: Unit and Specific Quantities, Model Testing of Hydraulic Turbines and Pumps. **Miscellaneous water lifting devices:** e.g. Air Lift Pumps, Hydraulic Ram, Bore Hole Pump, Submersible Pumps, Jet Pumps, Regenerative Pumps (Introduction)

TEXTBOOKS

Theory & Design of Hydraulic Machines, - V. P. Vasandani (Khanna Publications.)

2. Fluid Mechanics, - A. K. Jain (Khanna Publications.)

3. Fluid Mechanics & Fluid Power Engineering, - D. S. Kumar (Kataria Publications.)

4. Fluid Mechanics & Machines, - R. K. Bansal (Laxmi Publications.)

5. Fluid Mechanics & Machines, - Banga& Sharma (Khanna Publications.)

6. Fluid Mechanics & Machines, - R.K. Rjput (S.Chand Publications..)

REFERENCE BOOKS:

1. Fluid Mechanics with Engineering Applications, - Daugherty &Franizini (McGraw Hill Publications.)

2. Theory of Turbo – Machines, - A. T. Sayers, (McGraw Hill (india) Pvt. Ltd.)

3. Fundamentals of Turbomachines, - B.K. Vekanna

4. Fluid Mechanics & Hydraulic Machines, - Som&Biswas (TMH Publications.)

PCC-ME203 P	**Fluid Machines (PR)**	**0L :0T :2P**	**1 Credit**

Teaching Scheme	**Examination Scheme**
Practical: 2 Hours/Week	University Assessments 25 Marks College Assessment: 25 Marks

LIST OF PRACTICALS:

Minimum Eight practical from the following list shall be performed:

1. To run the centrifugal pump under various loading conditions and to draw the performance characteristic curves.
2. To conduct a test on Turbine/turbines wheel & plot the performance characteristic curves for constant load and head.
3. To study the performance of Reciprocating pump and draw the characteristic curves.
4. Determination of the Metacentric height of a floating body.
5. To study status of flow using Reynolds apparatus (Laminar and Turbulent).
6. Verification of Bernoulli's theorem.
7. Determination of the coefficient of discharge for a given Venturimeter.
8. Determination of the coefficient of discharge for a given Orificemeter.
9. Study and performance of Francis turbine at constant head.
10. To draw the characteristic curves of a Hydraulic Ram at constant valve lift and constant supply head.

A Journal/Report on experiments conducted shall be submitted by each student. University Practical examination shall be on viva-voce of 10 marks and practical performance or objective test of 15 marks.

PCC-ME 204	**STRENGTH OF MATERIALS** (Theory)	3L :0T :0P	3 Credits
Teaching Scheme	**Examination Scheme**		

Lectures: 3 Hours/Week	Duration of Paper: 03 Hours
Tutorial: 1Hour/Week	University Assessment: 80 Marks
	Marks College Assessment: 20 Marks

Course Outcomes:

CO1: To interpret, and analyze the conceptual fundamentals and numerical related to stress-strains as well as Principle stresses and Principle planes.

CO2: Design and Illustrate concept and fundamentals related to Shear forces and bending moment.

CO3: To infer and solve beam structures for determination of slope and deflection.

CO4: To develop and relate columns-struts as well as torsional concept of shafts.

CO5: To describe and analyze fundamentals of thin cylinders and spherical shells.

SYLLABUS:

UNIT 1:-

Concept of Simple Stresses & Strains :-

Introduction, stress, strain, types of stresses, Tensile ,Compressive, shear Stresses and strains.Stress-Strain diagram for brittle & ductile material, Elastic limit, Hooks law, , analysis of composite section, Thermal stresses & strain, Poisson`s ratio, volumetric stresses & strains ,

Elastic Constants and their Relations: Young's Modulus or Modulus of Elasticity, Modulus of Rigidity,Bulk Modulus, Relation between Young`s Modulus & Modulus of Rigidity, Poisson`s ratio, Factor of Safety.

Principle Stresses & Principle Planes :-Definition of principle planes & principle stresses, analytical method of determining stresses on oblique section when member is subjected to direct stresses in one plane in mutually perpendicular two planes, when member is subjected to shear stress &direct stresses in two mutually perpendicular planes,

Mohr`s Circle for representation of stresses. Maximum & Minimum Principle Stresses & Maximum Shear Stresses

UNIT 2:

Shear Force & Bending Moment Diagrams: -

Types of Beams-(Cantilever beam, Simply Supported Beam, & Overhanging Beams etc.) ,

Types of Loads- (Concentrated or point Loads & Uniformly Distributed Loads),

Shear Force & Bending Moment Diagrams for different types of beams subjected to different types of loads, Sign. Conventions for Bending moment & Shear force, shear force & bending moment diagrams for beams subjected to couple.

Stresses in Beams: -

Bending Stresses in Beams: Theory of simple bending with assumptions & expressions for bending

stress, Bending stress distribution and neutral axis, derivation of bending equation, bending stresses in symmetrical sections, Section Modulus for various shapes of beam sections.

Shear stresses in beams: - Concept and derivation of shear stress distribution , shear stress distribution diagram for common symmetrical sections.

UNIT 3:

Moment of Inertia and Polar Moment of Inertia.

Slope and Deflection of Beams: -

Deflection & Slope of Cantilever, Simply supported, Over- Hanging beams subjected to concentrated or point load, UDL using Double Integration Method, & Macaulay`s method, Relation between slope, deflection & radius of curvature. Maxwell Reciprocal Theorem

UNIT 4:

Torsion of Circular Shafts: -

Derivation of torsion equation with the assumptions . Torsion, shear stress induced in the shaft, when it is subjected to torque. Strength & rigidity criterion for design of shaft. Torque transmitted by solid & hollow circular shaft ,Stepped Shaft, Equivalent length of shaft.

Stresses and deflection in Helical Spring.

Column & Struts:-

Long & Short column, Slenderness Ratio, End Conditions for Column. Expression for Crippling load or Buckling Load for various end conditions of column. Effective length of column, Euler`s formula ,limitations of Euler`s formula, Rankine formula.

UNIT 5:

Thin Cylinders and Spherical Shells:

Longitudinal stresses and Circumferential or Hoop's Stresses,Failure of thin cylindrical shell due to an Internal Pressure, Design of Thin Cylindrical Shell, Deformation in Thick and Thin Cylinders, Deformation in Spherical Shells subjected to an Internal Pressure.

TEXT BOOKS:

1.Strength of Materials: S. Ramamurtham

2. Strength of Materials: R. K. Rajput

3. Strength of Materials: F. L. Singer

4. Mechanics of Materials:Beer& Johnson

5. Design of m/c elements: V. B. Bhandari

6. Design data book for M/c elements:B.D. Shiwalkar

7. Strength of Materiais: Dr. R.K.Bansal

REFERENCE BOOKS:

1.Strength of materials: Timoshenkos

2. Machine Design: Black & Adam

3. Machine Design: J. E. Shigley

PCC-ME-204 P	**STRENGTH OF MATERIALS** (Practical)	**0L :0T :2P**	**1 Credit**

Teaching Scheme
Lectures: 2 Hours/Week

Examination Scheme
University Assessment: 25 Marks
Marks College Assessment: 25 Marks

LIST OF PRACTICAL :

1. Tensile Test on Mild Steel Bar.
2. Compression Test On Concrete Block.
3. Shear Test on M.S.Bar
4. Impact Test on Mild Steel Specimen
5. Torsional Test for Circular Mild Steel Bar
6. Deflection of Cantelever and Simply Supported Beam
7. Determination of stiffness of Helical Compression Spring
8. Study of Universal Testing Machine.

A Journal/Report on experiments conducted shall be submitted by each student. University Practical examination shall be on viva-voce of 10 marks and practical performance or objective test of 15 marks.

PCC-ME 206	**INSTRUMENTATION AND CONTROL (Theory)**	**3L:1T:0P**	**4 credits**

Teaching Scheme
Lectures: 3 Hours/Week

Examination Scheme
Duration of Paper: 03 Hours

Tutorial: 1Hour/Week	University Assessment: 80 Marks College Assessment : 20 Marks

COURSE OBJECTIVES:

1. To provide a basic knowledge about measurement systems and their components
2. To learn about steady state errors
3. To learn about various sensors used for measurement of mechanical quantities
4. To inculcate basic knowledge of control system
5. To learn about system stability and control

COURSE OUTCOMES:-

1. Explain the measurement system and its characteristic
2. Differentiate various sensors for the measurement
3. Describe the basic elements of the control system
4. Interpret the stability of control system.

SYLLABUS:

UNIT–I **[8 Hrs.]**

Purpose, structure and elements of measuring system, static and dynamic characteristic of Measurement systems, generalised model of system elements, error sources, First and Second Order Instruments, Transfer Function G(S), Step, Ramp and Frequency Response, Dynamic Errors; **UNIT-II [8 Hrs.]**

Time domain Response analysis under transient inputs, steady state error analysis and error constants , PID controllers

UNIT – III **[8 Hrs.]**

Sensors for common engineering measurements (Linear & Angular Displacement and Speed, Strain, Force, Torque, Power, pressure

UNIT – IV **[8 Hrs.]**

A Control systems – basic elements, open/closed loop, design of block diagram; SFG, mathematical modelling of mechanical system

UNIT-V **[8 Hrs.]**

Stability analysis - Routh – Herwitz criterion of absolute stability and range stability , Root locus and bode plots

TEXTBOOKS

1.Principles of Measurement System - John P. Bentley, Pearson Education Asia.

2. Principles of Measurement Systems - NakraChaudhary

3. Principles of Measurement Systems - Beckwith Buck

4. Mechanical Measurement and Industrial Instrumentation - A. K. Sawhney

5. Mechanical Measurement and Industrial Instrumentation - D. S. Kumar

6. Mechanical Measurement and Industrial Instrumentation - R. K. Rajput

7. Instrumentation and control systems by W. Bolton, 2nd edition, Newnes, 200

8.Thomas G. Beckwith, Roy D. Marangoni, John H. LienhardV , Mechanical Measurements (6th Edition) 6th Edition, Pearson Education India, 2007

9.Gregory K. McMillan, Process/Industrial Instruments and Controls Handbook, Fifth Edition, McGraw-Hill: New York,1999.

MC - 02	**ENVIRONMENTAL SCIENCE**	**0L:0T:0P**	**0 Credit**

COURSE OUTCOMES

1. Develop an understanding of different natural resources including renewable resources
2. Realize the importance of ecosystem and biodiversity for maintaining ecological balance
3. Develop an understanding of environmental pollution and hazards due to industrialization and general measures to control them
4. Aware of important acts and laws in respect of environment

ACTIVITIES TO BE CARRIED OUT:-

- Visit to local area to document environmental assets-River/forest/ grass land / hill/ mountain etc.
- Visit to local or nearby polluted site -Urban/ rural/industrial etc.
- Study of common plants, Insects, Birds, animals, etc.
- Study of simple ecosystem – pond, river, hill slopes, etc.

TEXTBOOKS

1. Agarwal, K.C., 2001, Environmental Biology, Nidi Publ. Ltd., Bikaner.
2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad - 380 013, India.
3. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p.
4. Clark R.S., Marine Pollution, Clanderson Press Oxford
5. Cunningham, W.P.Cooper, T.H.Gorhani, E & Hepworth, M.T., 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p.
6. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
7. Jadhav, H & Bhosale, V.M. 1995, Environmental Protection and Laws, Himalaya Pub. House, Delhi. 284 p.
8. Miller T.G.. Jr., Environmental Science, Wadsworth Publishing Co.
9. Odum, E.P., 1971, Fundamentals of Ecology, W.B.Saunders Co., U.S.A., 574p.
10. Rao M.N. & Datta A.K.,1987, Waste Water Treatment, Oxford & IBH Publ. Co. Pvt. Ltd. 345 p.
11. Sharma B.K., 2001, Environmental Chemistry, Goel Publ. House, Meerut.
12. Trivedi R.K. and P.K. Goel, Introduction to Air Pollution, Techno-Science Publications
13. Wagner K.D., 1998, Environmental Management, W.B.Saunders Co., Philadelphia, USA 499p.
14. Dr. Deshpande, A.P.Dr. Chudiwale, A.D., Dr. Joshi, P.P., Dr. Lad, A.B.:Environmental Studies, Pimpalapure & Co., Publishers, Nagpur.
15. R.Rajagopalan : Environmental Studies, Oxford University Press, New Delhi,2005