Shri Rawatpura Sarkar University, Raipur

Examination Scheme & Syllabus

for

B.Tech in Mechanical Engineering

Semester-IV

(Effective from the session: 2022-23)

SHRI RAWATPURA SARKAR UNIVERSITY, RAIPUR, CHHATTISGARH
FACULTY OF ENGINEERING

Four Years B.Tech. Programmme
Scheme of Teaching and Examination
B.Tech. Fourth Semester Mechanical Engineering
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the session: 2022-23)

S.N	Course Code	Course Title	Hours per week			Credit	Examination Scheme			Sem End Exam Duration (Hrs)
			L	T	P		Continuous Evaluation	Sem End Exam	Total	
1.	BENME401T	Fluid Mechanics	3	1	-	4	**30**	**70**	**100**	**3**
2.	BENME401P	Fluid mechanics -Lab	-	-	4	2	**15**	**35**	**50**	**-**
3.	BENME402T	Mechanics of Solids- II	3	1	-	4	**30**	**70**	**100**	**3**
4.	BENME403T	Applied Thermodynamics	3	1	-	4	**30**	**70**	**100**	**3**
5.	BENME404T	Kinematics of Machines	3	1	-	4	**30**	**70**	**100**	**3**
6.	BENME404P	Kinematics of Mechanics-Lab	-	-	4	2	**15**	**35**	**50**	**-**
7.	BENME405T	Numerical Analysis & Computer Programming (C & C++)	3	1	-	4	**30**	**70**	**100**	**3**
8.	BENME405P	Numerical Analysis & Computer Programming-Lab	-	-	4	2	**15**	**35**	**50**	**-**
9.	BENME406T	Manufacturing Science-I	3	1	-	4	**30**	**70**	**100**	**3**
10	BENME407P	Computer Aided Drafting - Lab	-	-	4	2	**15**	**35**	**50**	**-**
						32			**800**	

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Course Title	**FLUID MECHANICS**				
Course Code	**BENME401T**				
Course Credits	**L**	**T**	**P**	**TC**	
	3	**1**	**-**	**4**	
Prerequisites	Applied physics and mathematics				
Course objectives	• Obtaining a solid understanding of the fundamentals of Fluid Mechanics • The ability to formulate basic equations for Fluid Engineering problems • The ability to use tables and figures to determine the friction energy loss for various pipes/ducts geometries and Fluid engineering applications • The ability to perform dimensional analysis and identify important parameters				
Course Contents	**UNIT-I** **Properties of fluid** Fluid, ideal and real fluid, properties of fluid : mass density, weight density, specific volume, specific gravity, viscosity, surface tension, capillarity, vapour pressure, compressibility and bulk modulus. Newtonian and non-Newtonian fluids Fluid Statics: Pressure, Pascal's law, Hydrostatic law, Manometry, Hydrostatic force on submerged plane and curved surface, Buoyancy and Flotation. **UNIT-II** **Fluid Kinematics** Description of fluid motion, Langragian and Eulerian approach, Type of fluid flow, Type of flow lines-path line, streak line, stream line, stream tube.Continuity equation, acceleration of a fluid particle, motion of fluid particle along curved path, Normal and tangential acceleration, Rotational flow, Rotation and Vorticity, circulation, stream and potential function, flow net ,its characteristics and utilities. Liquid in relative equilibrium. **UNIT- III** **Fluid Dynamics** Euler's Equation, Bernoulli's equation and its practical application, Venturimeter, Orifice meter, Nozzle, Pitot tube. Impulse momentum equation, Momentum of Momentum equation, Kinetic energy and Momentum correction factor, Vortex motion, Radial flow. **UNIT-IV** **Laminar Flow** Reynold's experiment, flow of viscous fluids in circular pipe, shear stress and pressure gradient relationship, Velocity distribution, Hagen-Poiseuille Equation, flow of viscous fluids between two parallel plates (Coutte flow) shear stress and pressure gradient relationship, Velocity distribution, Drop of pressure head. Turbulent flow: Effect of turbulence, Expression for loss of head due to friction in pipes (Darcy-Weisbach equation), Expression for co-efficient of friction in terms of shear stress. Flow through pipe: Loss of energy in pipes, Hydraulic gradient and total energy line, pipe in series and parallel, equivalent pipe power transmission through pipe, water hammer in pipes.				

	UNIT-V **Dimensional Analysis** Methods of dimensional analysis, Rayleigh's method, Buckingham's theorem, Limitations. Model analysis: Dimensionless number and their significance, model laws, Reynolod's model law, Fraude's model law, Euler's model law, Weber's model law, Mach's model law, Type of models, scale effect in model, limitation of hydraulic similitude
Course outcomes	• Apply knowledge of Fluid Mechanics formulating and solving engineering problems. • Acquire knowledge of fluid mechanics for the design and development of mechanical systems. • Demonstrate creativeness in designing new systems components and processes in the field of engineering in general and mechanical engineering in particular. • Identify, analysis, and solve mechanical engineering problems useful to the society. • Work effectively with engineering and science teams as well as with multidisciplinary designs.
Text book	1. D.S. Kumar– Kataria & Sons-" Fluid Mechanics and Fluid Power Engineering" — New Delhi 2. R. K. Rajput –"A text of Fluid Mechanics" — S. Chand & Company Ltd., Delhi
References book	1. R.K.Bansal- "Fluid Mechanics & Hydraulics Machine" Laxmi Publications.,Delhi 2. K.L. Kumar- "Engineering Fluid Mechanics"Eurasia Publication House, Delhi 3. B.S. Massey- "Mechanics of Fluid" English Language Book Society (U.K.) 4. Yunush A. Cengel, John M. Cimbala "Fluid Mechanics" TMH,Delhi

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<table>
<tr><td>Course Title</td><td colspan="5">MECHANICS OF SOLIDS- II</td></tr>
<tr><td>Course Code</td><td colspan="5">BENME402T</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>3</td><td>1</td><td>-</td><td>4</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Mechanics of Solids- I</td></tr>
<tr><td>Course objectives</td><td colspan="5">• To analyze solid mechanics problems using energy methods
• To analyze fixed beams and continuous beams.
• To solve for stresses and deflections of beams under unsymmetrical loading;
• To analyze column
• To analyze thin and thick pressure vessels</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT- I
Energy Methods
Introduction, Strain energy, Elastic strain energy in tension, compression, bending and torsion. Impact loading in tension and bending, Theorem of Castiglione’s and its applications, Reciprocal relations, Maxwell -Bett theorem,
UNIT-II
Fixed Beams
Fixed beam subjected to different types of loads and couples, Calculations of fixing moments and reactions at supports, deflection. Effect of sinking of support Continuous beams: Continuous beams subjected to different type of loads and couples, beams with overhang, beams with one end fixed, Chaperon’s theorem. Effect of sinking of supports.
UNIT- III
Bending of curved bars
Bending of curved bars in plane of loading, Winkler- Bach theory, crane hooks, chain links, bending of circular bars subjected to symmetric loading, bending of circular rings, stresses in circular rings.
UNIT-IV
Unsymmetrical Bending
Introduction to unsymmetrical bending, Stresses and deflection in unsymmetrical bending, Shear center for angle, Channel and I-sections.
Columns: Struts and Columns, Stability of columns, Euler’s formula for different end conditions, Equivalent load, Eccentric loading, Rankine’s formula.
UNIT-V</td></tr>
</table>

	Thin Pressure Vessel Thin Pressure Vessels, Circumferential and longitudinal stresses in thin cylindrical shells and thin spherical shell under internal pressure, Thick Pressure Vessel: Introduction, Lames Theorem, Thick Pressure vessels subjected to internal pressure, External Pressure & both, compound cylinders.
Course outcomes	• Apply knowledge of mechanics of deformable body for understanding, formulating and solving engineering problems. • Acquire knowledge and hands-on competence in applying the concepts mechanics of solid in the design and development of mechanical systems. • Demonstrate creativeness in designing new systems components and processes in the field of engineering in general and mechanical engineering in particular. • Identify, analysis, and solve mechanical engineering problems useful to the society. • Work effectively with engineering and science teams as well as with multidisciplinary designs
Text book	1. Timoshenko & Young –"Elements of Strength of Material" — EWP Press 2. S.S.Rattan –"Strength of Material" –TMH Publications
References Books	1.Sadhu Singh –"Strength of Material" — Khanna Publishers 2. gere and Timoshenko –"Mechanics of Material"- CBS Publications 3. H. Rider- "Strength of Materials" Macmillan 4.M. Gere and S.P. Timoshenko-"Mechanics of Material" — CBS publisher 5..P. Bear & E.E. Johnston –"Mechanics of Material" McGraw Hill 6.Shaums Outline Series –"Strength of Material" — McGraw Hill

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<table>
<tr><td>COURSE TITLE</td><td colspan="5">APPLIED THERMODYNAMICS</td></tr>
<tr><td>Course Code</td><td colspan="5">BENME403T</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>3</td><td>1</td><td>-</td><td>4</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Engineering thermodynamics& basic mechanical engineering</td></tr>
<tr><td>Course objectives</td><td colspan="5">• To understand the applications of engineering thermodynamics in real life situations
• To perform gas power cycle analysis
• To analyze reciprocating air compressors
• To perform vapor power cycle analysis
• To analyze steam condenser, cooling pond and cooling towers.
• To analyze thermodynamic system with compressible fluid.</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT- I
Gas power cycles
An overview of reciprocating engine, Air standard cycle, Otto, Diesel, dual cycle - Description and representation on P-V and T-S diagram, Thermal Efficiency, Mean Effective Pressures, comparison of cycles. An overview (only p-v and T-s diagram) of Stirling ,Erricson, Atkinson and Lenoir cycle
UNIT-II
Reciprocating Air Compressors
Classification of air compressors, working of single acting single cylinder reciprocating compressor, single acting reciprocating compressor without clearance, single acting reciprocating compressor with clearance-equation of work, volumetric efficiency. Multistage reciprocating air compressors, advantage of multistage compression, two stage air compressor-minimum work, Indicator diagram, mean effective pressure and indicated power, compressor power , efficiencies, shaft power of the compressor, Advantages and limitations of reciprocating compressors.
UNIT- III
Vapour Power Cycle
Simple steam power cycle, Rankine cycle; p-v, T-s and h-s diagrams, efficiency, steam rate, heat rate. Comparison of Rankine and Carnot cycles, mean temperature of heat addition, reheat cycle, ideal regenerative cycle, practical regenerative cycle, Feed Water Heaters (FWH)- open and closed FWH, characteristics of ideal working fluids, binary vapour cycle
UNIT-IV
Steam Condensers
The function of condenser, Element of a water cooled condensing unit, types of condenser, advantages and disadvantages of various types of condenser, condenser vacuum, mass of circulating water required, source of air its effects and removal, vacuum efficiency, condenser efficiency Cooling ponds and Cooling tower: Cooling pond, cooling towers, classification and working principles.</td></tr>
</table>

	UNIT-V **Thermodynamics of Compressible Fluids** Velocity of pressure waves in a fluid, Mach number, isentropic stagnation state , stagnation enthalpy, temperature, pressure, density, one dimensional steady isentropic flow, area velocity relationship, critical properties-choking in isentropic flow, dimensionless velocity, Effect of back pressure on the performance of nozzle flow. Flow of steam through nozzle, throat area for maximum discharge, supersaturated Flow in nozzle.
Course outcomes	• Apply knowledge of classical thermodynamics for formulating and solving engineering problems. • Acquire knowledge and hands-on competence in applying the concepts of thermal sciences in the design and development of mechanical systems. • Demonstrate creativeness in designing new systems components and processes in the field of engineering in general and mechanical engineering in particular. • Identify, analysis, and solve mechanical engineering problems useful to the society. • Work effectively with engineering and science teams as well as with multidisciplinary designs
Text book	1. Cengal & Boles –"Thermodynamics- An Engineering Approach" — McGraw Hill, Delhi 2. P.K. Nag –"Engineering Thermodynamics" — TMH Publishers
References book	1. Fundamental of engineering thermodynamics- R.Yadav ,CPH, Allahabad 2. D.S. Kumar-" Thermal Science & Engineering" — S.K. Kataria & Sons 3. Claus Borgnakke- "Fundamental of Thermodynamic" Richard E. Sonntag, Wiley,Delhi 4. Y.V.C.Rao –"An Introduction to Thermodynamics"-,University Prass, Hyderabad 5. J. Selwin Rajadurai –"Thermodynamics & Thermal Engineering" — New Age International Publishers

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Course Title	**KINEMATICS OF MACHINES**				
Course Code	**BENME404T**				
Course Credits	**L**	**T**	**P**	**TC**	
	3	**1**	**-**	**4**	
Prerequisites	**Basic Mechanical Engineering**				
Course objectives	• To synthesis, both graphically and analytically, multilink mechanisms. • To perform mechanism analyses to find the position, velocity, acceleration, and dynamics of multi-bar mechanisms. • To synthesis mechanism to perform certain prescribed task/motion • To analyze gear trains. • To analyze thrust bearings, Brakes and dynamometers.				
Course Contents	**UNIT- I** **Relative velocity** Elements, pairs, Mechanism, Four bar chain and its inversion, Velocity diagrams, Relative velocity method, Instantaneous centre method. **UNIT-II** **Relative Acceleration** Synthesis of mechanism, Pantograph, Lower pair mechanism, Relative acceleration diagram, Kliens construction, Coroillis component of acceleration. **UNIT- III** **Cams** Classification of cams and followers, Nomenclature of a radial cam, Description of follower movement, Displacement diagrams, Uniform and modified uniform motion, Simple harmonic motion, Uniform acceleration motion and its modifications, Cycloidal motion, Synthesis of cam profile by graphical approach, Considerations of pressure angle. Cams with specified contours: Circular arc cam & tangent cam. **UNIT-IV** **Gear** Types of gears, Gear terminology, Law of gearing, Gear tooth forms, Involute and Cycloid tooth profile, Interference and Undercutting of Involutes teeth, Minimum number of teeth on pinion to avoid interference. Gear trains: Simple, Compound, Reverted, and Epicyclical gear trains, computation of velocity ratio in gear trains by different methods. **UNIT-V** **Friction and Brakes and dynamometer** Applications of friction, Pivot and collar friction, Thrust bearing. Belt-Drives: Ratio of tensions for flat belt & V-belt, Centrifugal tension, condition for maximum power transmission. Brakes and dynamometer: Simple block and shoe brake, Band brake, Band and block brake, and internal expanding Shoe brake, Absorption dynamometer, Transmission dynamometer.				

Course outcomes	**At the end of this course student will be able to:** • Apply knowledge of Kinematics of machine for understanding, formulating and solving engineering problems. • Acquire knowledge and hands-on competence in applying the concepts kinematics of machine in the design and • Development of mechanical systems. • Demonstrate creativeness in designing new systems components and processes in the field of engineering • Identify, analysis, and solve mechanical engineering problems useful to the society. • Work effectively with engineering and science teams as well as with multidisciplinary designs
Text book	1. S. S. Ratan-"Theory of Machine" –-Tata McGraw Hill. 2. Thomas Beven –"The Theory of Machine" — CBS Publishers.
References book	1. A. Ghosh, A.K. Mallik –"Theory of mechanism and machine" —EWP Press. 2. Shigley, JE –"Theory of Machine" 3. Jagdish Lal-"Theory of Machine" 4. J.E. Singh –"Theory of machine" — McGraw Hill

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Course Title	**NUMERICAL ANALYSIS & COMPUTER PROGRAMMING (C & C++)**				
Course Code	**BENME405T**				
Course Credits	**L**	**T**	**P**	**TC**	
	3	**1**	**-**	**4**	
Prerequisites	Mathematics-III & Basic computer engineering and science				
Course objectives	• Find numerical approximations to the roots of an equation by Newton method, Bisection Method, Secant Method, etc. • Find numerical solution to a system of linear equations by Gaussian Elimination and Gauss-Siedel Iterative • Find numerical solution for Curve fitting • Find numerical solution for ordinary differential equation. • Find numerical solution for Partial differential equation. • To understand the basics of computer programming				
Course Contents	**UNIT- I** **Approximation and errors in computation** Approximation and round of errors, truncation errors and Taylor Series, Determination of roots of polynomials and transcendental equations by Graphical methods and Bisection, Regula-falsi, Secant and Newton-Raphson methods, Solution of Linear simultaneous, linear algebraic equations by Gauss Elimination Gauss-Jordan and Gauss-Siedel iteration method. **UNIT-II** **Empirical laws curve fitting & interpolation** Curve fitting linear and non-linear regression analysis (Method of group average and Least squares) Finite differences, Backward, forward and central difference relation and their use in Numerical differentiation and integration and their application in interpolation. **UNIT- III** **Numerical solution of ordinary differential equations** Numerical integration by Trapezoidal rule, Simpson's (1/3rd & 3/8th) rule and its error estimation. Application of difference relations in the solution of partial differential equations. Application of difference relations in the solution of partial differential equations. Numerical solution of ordinary differential equations by Taylor's series, Euler, Modified Euler, Runge-Kutta and Predictor-Corrector method. **UNIT-IV** **Numerical Solutions of Partial Differential Equations** Introduction, Classification of second order equations, Finite difference approximations to partial derivatives, Elliptic equations, solution of Laplace equation,				

	Solution of Poisson's equation, Solution of elliptic equations by relaxation method, Parabolic equations, Solution of one-dimensional heat equation, Solution of two-dimensional heat equation, Hyperbolic equations, solution of wave equation. **UNIT-V** **Computer Programming** I/O statement, Mathematical, Relational & Conditional Statements & Expressions. Switch Loops and Control Statements. Introduction to one dimensional arrays and two dimensional arrays. Basics of I/O file handling.
Course outcomes	**At the end of this course student will be able to:** • Apply knowledge of numerical analysis for understanding, formulating and solving engineering problems. • Acquire knowledge and hands-on competence in applying the concepts of Numerical Analysis and Computer Programming in the analysis of mechanical systems. • Identify, analysis, and solve mechanical engineering problems useful to the society. • Work effectively with engineering and science teams as well as with multidisciplinary analysis.
Text books	1. Dr. B.S. Grewal –"Numerical Methods in Engineering & Science" — Khanna Publishers, 6th Edn. 2004 2. P. Kandasamy, K. Thilagavathy & K. Gunavathy- "Numerical Methods" — S. Chand & Co., 2nd Rev. Edn. – 2003
Reference Books	1. Yashwant Kanitkar –"Let us C –5th Edn." – BPB Publihsers – New Delhi. 2004 2. S.S. Sastry –"Introductory Methods of Numerical Analysis –, 3rd Edn". – PHI – New Delhi, 2003 3. James B. Scarborough, - Numerical Mathematical Analysis –6th Edn. – Oxford & IBH Publishing Co. – New Delhi 4. T. Veerarajan, T. Ramchandran -Theory & Problems in Numerical Methods – – TMH, New Delhi, 2004 5. Steven C. Chapra, Raymond P. Canale- Numerical Methods for Engineers –, 4th Edn. – TMH, New Delhi 6. Henry Mullish & Herbert L. Cooper -The Spirit of C –- Jaico Pub. House

Course Title	**MANUFACTURING SCIENCE – I**				
Course Code	**BENME406T**				
Course Credits	**L**	**T**	**P**	**TC**	
	3	**1**	**-**	**4**	
Prerequisites	Manufacturing process and production engineering				
Course Objectives	• To understand various Casting processes • To understand various welding processes • To understand various metal removal process • To appreciate the capabilities, advantages and the limitations of the processes				
Course Contents	**UNIT- I** **Introduction To Manufacturing Processes** Importance of Manufacturing Processes, classification, technological definitions. Metal Casting (Foundry): Introduction: Basic Principle, Advantages and Limitations, Applications. Pattern Making: Pattern materials, allowances, types of pattern, color code scheme Mould Making: Green and dry sand casting process, types of sand, molding sand and its properties, molding sand composition and applications. Elements of mould: Cores; Use, core material, types of cores, advantages and limitations, core prints, chaplets, Gating and Risering System, Sand casting defects: appearance, causes & remedies. Special Molding Processes: Carbon dioxide molding process, investment casting process, Die casting process, shell molding process, continuous casting process, centrifugal casting processes. **UNIT-II** **Welding-I** Introduction Principle, classification based on application of filler material & without filler material, source of energy, fusing and pressure welding processes, application of welding processes. **Arc welding**: Principle, power source and equipment's, welding electrodes- types composition & specification, Metal Arc welding (MAW), flux Shielded Metal Arc Welding (FSMAW), Inert Gas Welding (TIG & MIG) Submerged Arc Welding (SAW) and Atomic Hydrogen Welding processes. (AHW). **Gas Welding**: Principle, Oxy-Acetylene welding, Reaction in Gas welding, Flame characteristics, Gas torch construction & working, forward and backward welding. **UNIT- III** **Welding – II** Resistance Welding: General, principle of heat generation in resistance welding, application of resistance welding processes. Process details and working principle of spot, seam and projection welding, electrode materials, shapes of electrodes, electrode cooling, selection of welding currents, voltages. Special type of welding: Friction welding, Explosive welding, Thermit welding, Laser welding, Electron				

	beam welding, Electroslag welding, Ultrasonic welding; principle, equipments, operations. Soldering, Brazing & Braze welding, Welding Defects. **UNIT-IV** **Machine Tools** Lathe: Principle of operation, basic parts of a lathe, types – speed lathe, engine, bench, tool room, capstan, turret, automatic, specification, construction, operations- facing, turning, knurling, taper turning, thread cutting, drilling, boring, reaming, work holding devices & tools, mechanism and attachments for various operations. Shaper: Principle of operation, parts, types horizontal, vertical, universal, Operations – horizontal cutting, vertical cutting, angular cutting, irregular cutting, specification, Quick return Mechanisms. Table feed mechanism, work holding devices. Planner: Principle of operation, parts, and types – double housing, open side, pit type, plate type, and divided table. Specification, types of drives. **UNIT-V** **Milling** Principle of operation, parts, specification, types- horizontal, vertical, universal, milling operations – plain, face, slotting, gear cutting mechanisms and attachments for milling, indexing-simple, compound and differential. Broaching: Principle of operation, parts, types of broaches- horizontal, vertical, pull, surface-internal and external broaching machines, nomenclature, of broach. Drilling: Principle of operation, parts, drill nomenclature, types of drilling machines, other operations like counter boring, counter sinking, spot facing etc. Reaming: Principle of operation, parts, description of reamers, type of reaming operations. Boring: Principle of operation, parts, types of boring machines, boring operations, boring tools.\
Course outcomes	**At the end of this course student will be able to:** • Acquire knowledge and hands-on competence in applying the concepts of manufacturing science in the design and development of mechanical systems. • Demonstrate creativeness in designing new systems components and processes in the field of engineering in general and mechanical engineering in particular. • Work effectively with engineering and science teams as well as with multidisciplinary designs. • Skillfully use modern engineering tools and techniques for mechanical engineering design, analysis and application.
Text book	1. P.N. Rao-"Manufacturing Technology (Vol. – I & II)" — Tata McGraw Hill Pub. Company, New Delhi. 2. P.C. Sharma-" A Text Book of Production Technology (Manufacturing Processes)" — S. Chand and Company Ltd., New Delhi.

Reference Books	1. A. Ghosh & A.K. Mallik- "Manufacturing Science" — East West Press Pvt. Ltd., New Delhi 2. S. Kalpakjian & S.R. Schmid- "Manufacturing Engineering and Technology" — Addision Wesley Longman, New Delhi 3. R. K. Jain –"Production Technology" — Khanna Publishers, New Delhi 4. O.P. Khanna –"A Text Book of Production Technology (Vol. I & II)" — Dhanpat Rai & Sons, New Delhi.

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<table>
<tr><td>Course Title</td><td colspan="5">FLUID MECHANICS -LAB</td></tr>
<tr><td>Course Code</td><td colspan="5">BENME401P</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>-</td><td>-</td><td>4</td><td>2</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Basic mechanical and mathematics</td></tr>
<tr><td>Course objectives</td><td colspan="5">• The ability to use tables and figures to determine the friction energy loss for various pipes/ducts geometries and Fluid engineering applications.
• The ability to perform dimensional analysis and identify important parameters</td></tr>
<tr><td>Course Contents</td><td colspan="5">LIST OF EXPERIMENTS
List of Experiments: (At least Ten experiments are to be performed by each student)
1. To determine the meta-centric height of a ship model.
2. To verify Bernoulli’s Theorem.
3. To verify Impulse Momentum Principle.
4. To calibrate a Venturi meter and study the variation of coefficient of discharge.
5. To calibrate an orifice-meter.
6. Experimental determination of critical velocity in pipe.
7. To determine of head loss in various pipe fittings.
8. Flow measurement using Pitot tube.
9. To study the transition from laminar to turbulent flow and to determine the lower critical Reynold’s number.
10. To determine the hydraulic coefficients (Cc, Cd and Cv) of an orifice.
11. To determine the coefficient of discharge of a mouth piece.
12. To obtain the surface profile and the total head distribution of a forced vortex.
13. To study the variation of friction factor for pipe flow.
15. To determine the roughness coefficient of an open channel.</td></tr>
<tr><td>Equipment/ Machines used</td><td colspan="5">• Apparatus for determination of metacentric height
• Bernoulli’s apparatus
• Impact of jet apparatus
• Venturimeter
• Orifice meter
• Pipe friction apparatus
• Orifice apparatus
• Mouth Piece apparatus with the provision for determination of hydraulic coefficient Cc, Cd & Cv
• Vortex flow apparatus
• Apparatus of head loss in various pipe fittings.
• Reynold’s apparatus
• Complete setup for flow measurement using Pitot tube
• Complete set for open channel apparatus</td></tr>
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<table>
<tr><td>Course Title</td><td colspan="5">COMPUTER AIDED DRAFTING -LAB</td></tr>
<tr><td>Course Code</td><td colspan="5">BENME407P</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>-</td><td>-</td><td>4</td><td>2</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Computer fundamental and basic computer engineering</td></tr>
<tr><td>Course objectives</td><td colspan="5">• Evaluate mechanical designs and select the proper process and materials for production.
• Create 2D and 3D computer drawings and models for manufacturing and prototyping.
• Evaluate computer aided design models and assemblies based on critical thinking and problem-solving skills.
• Collaborate with people of diverse backgrounds and abilities.
• Develop a solution through group work.
• Communicate and present ideas and solutions to design problems.
• The ability to perform dimensional analysis and identify important parameters</td></tr>
<tr><td>Course Contents</td><td colspan="5">LIST OF EXPERIMENTS
1. Understanding of various 3D CAD commands and creating simple 3D objects.
2. Understanding of holes, cuts and model tree relations.
3. Creation shafts, rounds, chamfers and slots.
4. Sketch Tools & Datum planes
5. Creation of objects by Extrusion, revolved features (Simple protrusion), patterns and copies.
6. Creation of objects by sweeps and blends (Advance protrusion) methods.
7. Creation of engineering drawing details such as dimensioning, sectional views, adding esthetics.
8. Assembling of part models using constraints
9. Assembly operations - part modifications, adding another assembly features – display.</td></tr>
<tr><td>Course outcomes</td><td colspan="5">At the end of this course student will be able to:
• Create 2D and 3D computer drawings and models for manufacturing and prototyping.
• Evaluate computer aided design models and assemblies based on critical thinking and problem-solving skills.
• Develop a solution through group work.</td></tr>
</table>

Equipment/ Machine Used	**Equipment/Machines/Instruments/Tools/Software Required:** **List of Equipment/Instruments/Machines/Software Required:** 1. P-IV, 2.6 G. Hz., 128/256 MB SDRAM, 40 GB HDD, 1.44 MB FDD, 14" Colour Monitor, 52 X CD RW, Laser Scroll Mouse 2. Software Required – Drafting Software.

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<table>
<tr><td>Course Title</td><td colspan="5">KINEMATICS OF MACHINE-LAB</td></tr>
<tr><td>Course Code</td><td colspan="5">BENME405P</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>-</td><td>-</td><td>4</td><td>2</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Basic mechanical and mathematics</td></tr>
<tr><td>Course Contents</td><td colspan="5">LIST OF EXPERIMENTS
1. To determine the jump phenomena of cam follower apparatus.
2. To draw displacement, velocity and acceleration curve of cam motion.
3. To find out the load carrying capacity of bearing.
4. To find out the Coefficient of friction of bearing.
5. To find out the frictional horse power of bearing.
6. To find out the Pressure around the bearing by journal bearing apparatus.
7. To measure co-efficient of friction, power transmitted with varied belt tension by slip & creep apparatus.
8. To find out the percentage slip at fixed belt tension by varying load with slip & creep apparatus.
9. To find out belt slip and creep by slip and creep measurement apparatus.
10. To verify the coriolli’s component of acceleration with theoretical and practical results.
11. To find the speed and torque of different gear in an epicyclic gear train.
12. To find the speed and torque of different gear in a simple, compound and reverted gear train.
13. To Study and analysis of Pantograph.
14. To study Four-bar mechanism and its inversions.
15. To study internal expanding and external contracting shoe brakes.</td></tr>
<tr><td>Course outcomes</td><td colspan="5">At the end of this course student will be able to:
• Ability to analyze the force analysis & power calculation of brake & dynamometer.
• Ability to conduct static & dynamics forces analysis & equilibrium of forces of mechanical system.
• Study about all different mechanical parts such as link, joint, kinematic chain etc.</td></tr>
</table>

Equipment/ Machine Used	**EQUIPMENT/MACHINES/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED** • Cam analysis apparatus • Journal bearing apparatus. • Coriolli's component of acceleration apparatus • Slip & Creep Measurement Apparatus in Belt Drive • Simple, compound, reverted and epicyclic gear train apparatus. • Pantograph apparatus (with all accessories) • Internal / external shoe brake (complete set with accessories) • Four bar mechanism and its inversions. • Rope brake dynamometer apparatus (with all accessories) • Mechanoset.

SHRI RAWATPURA SARKAR UNIVERSITY, RAIPUR, CHHATTISGARH
FACULTY OF ENGINEERING

<table>
<tr><td>Course Title</td><td colspan="5">NUMERICAL ANALYSIS & COMPUTER PROGRAMMING -LAB</td></tr>
<tr><td>Course Code</td><td colspan="5">BENME405P</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>-</td><td>-</td><td>4</td><td>2</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Mathematical analysis and computer engineering</td></tr>
<tr><td>Course objectives</td><td colspan="5">• To learn about existence and uniqueness criteria for numerical methods
• To learn about convergences criteria and to be aware of reasons why numerical methods may fail.</td></tr>
<tr><td>Course Contents</td><td colspan="5">LIST OF EXPERIMENTS
1. Write a program to calculate the area & perimeter of the rectangle and the area & circumference of the circle. The length and breadth of a rectangle and radius of a circle are input through keyboard.
2. Write a program to determine whether the character entered through a keyboard is a capital letter, a small case letter, a digit or a special symbol.
3. Write a program to add first seven terms of the following series using looping statements series is
4. Write a program which has the following options:
a. Factorial of a number
b. Prime or not
c. Odd or even
5. Write a program to implement Bubble sort on a set of 10 numbers.
6. Write a program to store every character typed at the keyboard into a file. The procedure should come to an end as soon as the ‘Esc’ key is pressed.
7. Write a program to find the roots of an equation using Newton Raphson Method.
8. Write a program to practice one of the Numerical Integration Method.
9. Write a program to find the solution of Differential Equation by Modified Euler’s Equation.
10. Write a program to find the solution of Differential Equation by Runge Kutta Equation.</td></tr>
<tr><td>Course outcomes</td><td colspan="5">At the end of this course student will be able to:
1. Work on any measurement prepares some useful product.
2. Actual measurement of job.
3. Prepare a job related to for Work and metal cutting measuring the dimension of job.
4. Temperature measurement and deformation measurement of job.</td></tr>
<tr><td>Equipment/ Machine Used</td><td colspan="5">List of Equipment/Instruments/Machines/Software Required:
1. P-IV, 2.6 G. Hz., 128/256 MB SDRAM, 40 GB HDD, 1.44 MB FDD, 14” Colour Monitor, 52 X CD RW, Laser Scroll Mouse
2. Software Required – C & C++</td></tr>
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