Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Technology and Science

Choice Based Credit System (CBCS) Scheme in light of NEP-2020

B. Tech/B.Tech+MBA in Mechanical Engineering

(2021-2025)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTME401	DCC	FLUID MECHANICS	60	20	20	30	20	3	0	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):

To introduction with (A) Fluid and its properties, (B) behavior of fluid under various conditions, (C) Applications.

Course Outcomes (COs):

After the successful completion of this course students will be able to

1. Understand the fundamentals of fluid mechanics.
2. Understand basics of compressible flow.
3. Understand fundamentals of flow through pipes.
4. Understand statics, dynamics and various approaches to fluid mechanics.

Syllabus

Unit – I **(9 Hrs)**

Flow and Fluid Properties: Viscosity, relationship between stress and strain-rate for Newtonian fluids, incompressible and compressible flows, differences between laminar and turbulent flows. Hydrostatics forces: Buoyancy and floatation, manometer, forces on submerged and floating bodies, stability conditions.

Unit – II **(9 Hrs)**

Kinematics: Types of fluid flow, rate of flow or discharge continuity equation, velocity and acceleration, velocity potential function and stream function, types of motion, vortex flow.
Ideal flow: Uniform flow, source flow, sink flow, free vortex flow.

Unit – III **(10 Hrs)**

Differential Analysis: Differential equations of mass and momentum for incompressible flows, inviscid - Euler equation and viscous flows - Navier-Stokes equations, Bernoulli's equation from Euler's equation and assumptions, concept of fluid rotation, vorticity, stream function, Exact solutions of Navier-Stokes equation for Coquette Flow and Poiseuille flow, Orifices and mouthpieces: classifications of and flow through orifice, hydraulic coefficients, experimental determination of hydraulic coefficients, classification and flow through convergent and divergent mouthpiece.

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Unit – IV **(9 Hrs)**

Dimensional Analysis: Introduction, secondary or derived quantities, methods of dimensional analysis, model analysis, similitudes-types of similarities, dimensionless numbers, models law and Concept of geometric, kinematic and dynamic similarity, some common non-dimensional parameters and their physical significance: Reynolds number, Froude number and Mach number.
Internal Flows: Fully developed pipe flow, various losses in pipe flow, empirical relations for laminar and turbulent flows: friction factor and Darcy-Weisbach relation.

Unit-V **(8 Hrs)**

Prandtl Boundary Layer Equations: Concept and assumptions, qualitative idea of boundary layer and separation, streamlined and bluff bodies, drag and lift forces. Flow measurements: Basic ideas of flow measurement using venturimeter, Pitot - static tube and orifice plate.

Text and Reference Books:

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, S.K. kataria & Sons, 2015.
2. Fluid Mechanics and Hydraulic Machines by R.K. Bansal, Laxmi Publications, 2016.
3. Fluid Mechanics and Hydraulic Machines by R.K. Rajput, S. Chand & Co., 2017.
4. Fluid Mechanics by F. M. White, 5th ed., McGraw-Hill, New York, 2007.
5. Fundamentals of Fluid Mechanics by Munson, Willey India, 2012.
6. Fluid Mechnaics by A.K. Mohanty, PHI Learning Pvt. Ltd., 2011
7. Textbook of Fluid Mechanics by Suparna Mukhopadhyay, CBS Pub. 2015.

List of Experiments

1. To understand pressure measurement procedure and related instruments/devices.
2. To study meta-centric height of floating body.
3. Verification of Bernoulli's Theorem.
4. To study the velocity of flow using Pitot tube.
5. To determine the Coefficient of discharge through different flow meters. (Any two out of Orifice meter, Venturimeter and Nozzle meter.)
6. To determine the different types of flow Patterns by Reynolds experiment.
7. To study the Friction factor for the different pipes.
8. To study the loss coefficients for different pipe fittings.

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Choice Based Credit System (CBCS) Scheme in light of NEP2020

B. Tech/B. Tech + MBA in Automobile Engineering

(2021-2025)

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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTAU406	DCC	**KINEMATICS AND DYNAMICS OF MACHINES**	60	20	20	30	20	3	1	2	**5**

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):

This course provides comprehensive knowledge of (A) Mechanism and machine (B) Kinematics of plane motion, (C) Cam and Follower, (D) Gears and Gear Train, (E) Gyroscope and Governor Mechanisms.

Course Outcomes (COs):

After the successful completion of this course

1. Students will be able to define systematically design and develop mechanisms to perform a specified task and demonstrate an understanding of the concepts of various mechanisms and pairs.
2. Students will be able to analyse Cam movement.
3. Students will be able demonstrate an understanding of principle of gears.
4. Students will be able to synthesis simple gyroscopic forces and couple, and gyroscopic effect in airplanes, ship and vehicle.
5. Students will be able to understand the basics of Balancing of masses and Governor Mechanisms.

Syllabus

Unit – I **12 Hrs**

Mechanisms and Machines: Mechanism, machine, plane and space mechanism, kinematic pairs, kinematic chains their classification, degrees of freedom, Grubler's criterion, kinematics inversions four bar mechanism and slider crank mechanism, equivalent linkages, pantograph, straight line motion mechanism, Devis and Ackermann's steering mechanism, Hooke;s joint.

Unit – II **11 Hrs**

Motion: kinematics of Plane motion, Absolute & Relative motion, Displacement, Velocity and Acceleration Analysis by Graphical & Analytical methods, Velocity of rubbing, Kennedy's Theorem, Coriolis acceleration component, Klein's construction, Velocity and Acceleration Analysis using complex Raven's methods.

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BTAU406	DCC	**KINEMATICS AND DYNAMICS OF MACHINES**	60	20	20	30	20	3	1	2	**5**

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Unit – III **12 Hrs**

Cams: Classification of Cams and Followers, Radial Cam Terminology, Analysis of Follower motion, Pressure Angle, Radius of Curvature, Cam Profile for radial and offset followers Synthesis of Cam Profile by Graphical Approach.

Dynamic Analysis of Cams: Response of un-damped cam mechanism (analytical method), follower response analysis by phase-plane method, jump and cross-over shock.

Unit – IV **15 Hrs**

Gears and Gear Trains: Classification of gears and its type, Gear Terminology, Law of gearing, Tooth profiles, velocity of sliding, Path of contact, Arc of contact, Contact Ratio, Interference and Undercutting, Conjugate action. Simple, compound, reverted and epi-cyclic gear trains. Velocity ratio and torque calculation in gear trains.

Belt drives: Velocity ratio, limiting ratio of tension; power transmitted; centrifugal effect on belts; maximum power transmitted by belt; initial tension; creep; chain and rope drives.

Gyroscope: Gyroscopic Action in Machines, Angular Velocity and Acceleration, Gyroscopic torque/ couple, Gyroscopic effect on Naval Ships, Stability of Two- and Four-Wheel Vehicles.

Unit – V **10 Hrs**

Balancing of Inertia Forces: Balancing of rotating masses; Two plane balancing; Determination of balancing masses (graphical and analytical methods); Balancing of rotors; Balancing of internal combustion engines.

Governor Mechanisms: Types of governors, characteristics of centrifugal governors, gravity and spring controlled centrifugal governors; hunting of centrifugal governors; inertia governors.

Text and Reference Books:

1. *"Mechanism and Machine Theory, by Ambekar AG; PHI. Eastern Economy Edition 2015*
2. *" Theory of machines & Mechanism by"Uicker & Shigley, Second Edition Oxford University Press*
3. *" Theory of Machines,"by Dr. Jagdish Lal; Metropolitan Book Co; Delhi*

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BTAU406	DCC	**KINEMATICS AND DYNAMICS OF MACHINES**	60	20	20	30	20	3	1	2	**5**

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

4. *Mechanism and Machine Theory, by Rao J S and Dukkipati; New Age Delhi.*
5. *"Theory of Machines" by S.S. Rattan, (2009), Third Edition, Tata McGraw-Hill*
6. *"Theory of Mechanisms and Machines", by Ghosh and Malik; Publisher: East-West Press, 2015.*
7. *"Kinematics and dynamics of machinery", by Norton RL; Publisher: TMH, 2009.*

List of Experiments

1. To synthesize and demonstrate the inversion of four bar mechanism through animation and model.
2. To synthesize and demonstrate the inversion of single slider and double slider crank mechanism through animation and model.
3. To construct and demonstrate the steering mechanism based on Davis & Ackermann's Steering mechanisms principles.
4. To find out velocity & acceleration of slider crank mechanism by Klein's Construction.
5. To Study dynamic behaviour of cam & follower under various operating conditions using CAM Analysis Apparatus.
6. To draw Involutes profile of a gear by generating method.
7. To find out velocity ratio of various gear trains.
8. To study various types of belt drives & find out the velocity ratio of the drive.
9. To determine gyroscopic couple on Motorized Gyroscope.
10. To study gyroscopic effects through models.
11. To Perform Experiment on Watt and Porter Governors & also Prepare Performance Characteristic Curves in order to find Stability & Sensitivity.

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BTAU403	DCC	**AUTOMOTIVE ENGINES**	60	20	20	30	20	3	1	2	**5**

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs)

This course provides a fundamental understanding (A) To impart the knowledge of working of I.C. engines (B) To impart the knowledge of fuel injection and ignition system (C) To impart the detail knowledge of fuel combustion (D) To develop the knowledge of cooling and lubrication system of IC engines (E) To impart the ability of determination of engine performances through Testing.

Course Outcomes (COs)

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

1. Explain the working of IC engines and air standard cycles.
2. Describe the fuel injection and ignition system.
3. Illustrate the engine combustion parameters.
4. Understand the cooling and lubrication system.
5. Evaluate Engine performance, combustion and emission Parameters.

Syllabus

Unit – I **14 Hrs**

Air Standard Cycles: Internal and external combustion engines, classification and applications of I.C. Engines, IC engine components and terminology, four stroke cycle engines and two stroke cycle engines, Assumptions made in air standard cycle, Otto cycle, diesel cycle, dual combustion cycle, comparison of Otto, diesel and dual combustion cycles, Stirling and Ericsson cycles, air standard efficiency, specific work output, specific weight, work ratio, mean effective pressure, deviation of actual engine cycle from ideal cycle, valve and port timing diagrams.

Unit – II **12 Hrs**

Carburetion: Factors influencing carburetion, mixture requirements for various operating conditions, types of carburettors.

Fuel Injection System: Functional requirements of an injection system, types of inject systems, components of injection system.

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BTAU403	DCC	AUTOMOTIVE ENGINES	60	20	20	30	20	3	1	2	5

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Ignition System: Requirements of ignition system, battery ignition system, magneto ignition system, electronic ignition system, firing order, ignition timing.

Unit – III **10 Hrs**

Combustion in S.I. engines: Stages of combustion in S.I. engines, effect of engine variables on ignition lag, combustion phenomenon, knock in S.I. engines, effects of engine variables on knock, combustion chamber for S.I. engines.

Combustion in C.I. engines: Stages of combustion in C.I. engines, variables affecting delay period, knock in C.I. engines, C.I. engine combustion chambers.

Unit – IV **9 Hrs**

Lubrication and Cooling Systems: Functions of a lubricating system, types of lubrication system; mist, wet sump and dry sump systems, crankcase ventilation, properties of lubricant, SAE rating of lubricants, engine performance and lubrication, necessity of engine cooling, effect of engine variables on engine heat transfer, different types of cooling systems.

Unit – V **15 Hrs**

Performance parameters of IC engines: Engine power, engine efficiencies, mechanical efficiency, brake mean effective pressure and indicative mean effective pressure, torque, specific fuel consumption (BSFC, ISFC), variable affects engine performance, heat balance, engine performance curves.

Engine measurements and Testing: Friction power, indicated power, brake power, fuel and air consumption, speed, temperature of coolant and exhaust, noise and emission measurement.

Pollution and Its Control: Pollutants from S.I. and C.I. engines, Methods of emission control, alternative fuels for I.C. Engines, catalytic convertor.

Text and Reference Books:

1. *"Internal Combustion Engine Fundamentals", by J.B. Heywood, McGraw-Hill, 5th edition.*

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BTAU403	DCC	**AUTOMOTIVE ENGINES**	60	20	20	30	20	3	1	2	**5**

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

2. *"Fundamentals of Internal Combustion Engines", by Paul W. Gill & James H. Smith, Oxford & IBH Pub. Ltd., 4th edition.*
3. *"A Course in Internal Combustion Engines", by V. M. Domkundwar, Dhanpat Rai Publication, 3rd edition.*
4. *"Internal Combustion Engines", by V. Ganesan, Tata McGraw-Hill, 2nd edition.*
5. *"Internal Combustion Engines", by M.L. Mathur & R.P. Sharma, Dhanpat Rai Publications, 4th edition.*

List of Experiments

1. To study the working of 2 stroke and 4 stroke petrol (S.I.) engine
2. To study the working of 2 stroke and 4 stroke diesel (C.I.) engine
3. To study valve/port timing diagram of I.C. Engines.
4. To study fuel injection and ignition system of both S.I. & C.I. engines.
5. To study the different lubrication systems of I.C. engine.
6. Evaluate performance of 4-stroke C.I. engine and prepare heat balance sheet.
7. Evaluate performance of 2-stroke C.I. engine and prepare heat balance sheet.
8. Performance evaluation of four stroke S.I. engine.
9. Performance evaluation of two stroke S.I. engine
10. Performance evaluation of multi-cylinder Diesel/Petrol Engine.

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BTME404	DCC	MACHINE DESIGN I	60	20	20	30	20	3	0	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):

1. To understand the design methodology for machine elements.
2. To analyse the forces acting on a machine element,
3. Apply suitable design methodology.
4. To understand the various standards and methods of standardization.
5. To apply the concept of parametric design and validation by strength analysis.

Course Outcomes (COs):

Student will be able to

1. Understand the design concepts of various machine elements.
2. Design the various types of springs.
3. Design the shafts and couplings.
4. Design the threaded and welded joints.
5. Understand the concepts of bearing lubrication and design the journal bearings.

Syllabus

Unit –I **(8 Hrs)**

Introduction: Introduction to Design process, Design considerations, engineering materials properties and processes of their selection, BIS designation of steels, manufacturing considerations in design, Bending and Torsional stress equations, Impact and Shock loading, Stress concentration factor, Size factor, Surface limits factor, Design stress.

Unit –II **(10 Hrs)**

Fatigue strength and design of springs: Variable and cyclic loads, Fatigue Strength, Endurance limit, S- N Curve, Soderberg, Gerber and Goodman equations, fatigue failure, design consideration in fatigue, classification and spring materials, Spring end formation, Design of helical compression springs, helical extension springs, torsion springs, laminated springs, Protective coatings, Equalized stress in spring leaves. Multi - leaf springs. Surge in springs, nipping and shot peening.

Unit –III **(9 Hrs)**

Shafts, keys and couplings: Shafts design on strength basis, torsional rigidity basis, ASME

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BTME404	DCC	MACHINE DESIGN I	60	20	20	30	20	3	0	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
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codes for shafts, Keys and cotter design, Flat and square keys, Splines, Rigid and flange couplings, Flexible couplings.

Unit –IV **(9 Hrs)**

Threaded and welded joints: Forms of threads, basic types of screw fastenings, ISO metric screw threads, eccentrically loaded bolted joints, Torque requirement for bolt tightening, Fluctuations loads on bolted joints, fasteners, Joints with combined stresses. Power screws, Force analysis. Collar friction, Differential and compound screws design. Types and strength of weld joints subjected to bending and fluctuating loads, cotter and knuckle joints, welded joints, different types welded joints and their design aspects.

Unit – V **(9 Hrs)**

Journal Bearing: Types of lubrication, viscosity, hydrodynamic theory, design factors, temperature and viscosity considerations, Reynold's equation, stable and unstable operation, heat dissipation and thermal equilibrium, boundary lubrication, dimensionless numbers, Design of journal bearings, Rolling-element Bearings: Types of rolling contact bearing, bearing friction and power loss, bearing life; Radial, thrust & axial loads; Static & dynamic load capacities; Selection of ball and roller bearings; lubrication and sealing.

Text and Reference Books:

1. Design of Machine Elements by V.B. Bhandari, TMH, 3rd Ed. 2010.
2. Machine Design by R.S. Khurmi nad J.K. Gupta, Eurasia Pub. House, 2013.
3. Machine Design by J.E. Shingley, TMH, 2011.
4. Design of Machine Elements by Sharma and Purohit, PHI, 2014.
5. Machine Design by Wentzell Timothy H., Cengage learning, 2008.
6. Machine Design by Mubeen, Khanna Pub. 2013.
7. Machine Design by Sharma and Agrawal, Kataria & Sons, 2016.

List of Experiments

Solve various design problems as per the syllabus

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BTAU405	DCC	**AUTOMOTIVE COMPONENT LAB**	0	0	0	30	20	0	0	2	**1**

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):

1. Basic understanding of various automotive components.
2. Identify various automotive systems and their components.
3. Impart knowledge of functions of various automotive components.

Course Outcomes (COs):

After learning the course, the students should be able to:

(1). Students will be able to identify various automotive components.
(2). Students will be able to identify different systems and their components.
(3). Students will be able to describe functions of various automotive systems and components.

Syllabus

30 Hrs.

Components of chassis & body, components of automotive suspension system, components of steering system and steering mechanisms, components of transmission system, gear-box, differential systems, Component of IC Engine, automotive emission and its control, electrical systems of various light and heavy automotive vehicles

List of Experiments

1. Describe various components of chassis and body of automobile.
2. Describe various components of steering system.
3. Describe various components of transmission system.
4. Describe the function of gear box and differential.
5. Describe various components of suspension system.
6. Describe various components of IC Engine.
7. Assemble & dissemble the part of 2 Stroke Petrol Engine.
8. Assemble & dissemble the part of 4 Stroke Diesel Engine.
9. Describe various components of emission & pollution control system.
10. Describe various components of electrical and control system.

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