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SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSMENT*				
BTMA301	ODS	APPLIED MATHEMATICS III	60	20	20	0	0	3	1	0	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 20 marks.

Course Educational Objectives (CEOs):

To introduce the students with the fundamentals of the calculus of the (A) Complex Variable, (B) Random Variable and (C) Fourier Analysis.

Course Outcomes (COs):

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

1. Understand and apply the basics of the Calculus of the Complex variables.
2. Know the fundamentals of the Probability Theory and Random Process.
3. Apply the concepts of the Fourier Analysis
4. Know the techniques of the Fourier Transform.
5. Find the solution of the PDE.

Syllabus

Unit-I

Complex Analysis: Complex numbers, geometric representation, powers and roots of complex numbers. Functions of a complex variable: Limit, Continuity, Differentiability, Analytic functions, Cauchy-Riemann equations, Harmonic functions, Harmonic conjugates. Elementary Analytic functions (polynomials, exponential function, trigonometric functions), Complex integration, Cauchy's integral theorem, Cauchy's integral formula. Taylor series and Laurent series. Zeros, Singularities and its classifications, Residues, Residue theorem and its applications.

Unit– II

Probability Theory and Random Process: Axiomatic construction of the theory of probability, independence, conditional probability, and basic formulae, random variables, binomial, poisson and normal random variable, probability distributions, functions of random variables;
mathematical expectations, Definition and classification of random processes, discrete-time Markov chains, Poisson process, Correlation and Regression; Expectation and Variance.

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Unit–III

Fourier series: Fourier Integral, Fourier series of 2p periodic functions, Fourier series of odd and even functions, Half-range series, Convergence of Fourier series, Gibb's phenomenon, Differentiation and Integration of Fourier series, Complex form of Fourier series.

Unit–IV

Fourier Transformation: Fourier Integral Theorem, Fourier Transforms, Properties of Fourier Transform, Convolution and its physical interpretation, Statement of Fubini's theorem, Convolution theorems, Inversion theorem

Unit–V

Partial Differential Equations: Introduction to PDEs, basic concepts, Linear and non-linear first order PDE, Higher order linear homogeneous PDE, Separation of variable and its application to the one dimensional wave and heat equation.

Reference Books:

1. *"Complex Variables and Applications" b y R. V. Churchill and J. W. Brown, 5th Edition, McGraw-Hill, 1990.*
2. *"Introduction to Partial Differential Equations", by K. Sankara Rao, 2nd Edition, 2005.*
3. *"Introduction to Probability Theory", by P. G. Hoel, S. C. Port and C. J. Stone, Universal Book Stall, 2000.*
4. *"Probability and Statistics with Reliability, Queuing, and Computer Science Applications", by K. S. Trivedi, Prentice Hall of India, 1998.*
5. *"Probabilities, Random Variables and Stochastic Processes", by A. Papoulis and S. Unnikrishna Pillai4th Edition, Tata McGraw-Hill, 2002.*
6. *"Stochastic Processes", by S.M. Ross, 2nd Edition, Wiley, 1996.*
7. *"Higher Engineering Mathematics", by B. S. Grewal, Khanna Publishers, Delhi.*
8. *"Complex Analysis for Mathematics and Engineering", by 3rd Edition, J. H. Mathews and R. W. Howell, Narosa, 1998.*
9. *"Elements of Partial Differential Equations", by I. N. Sneddon, McGraw-Hill, 1957.*
10. *"Advanced Engineering Mathematics", by E. Kreyszig, 5th / 8th Edition, Wiley Eastern / John Wiley, 1983/1999.*

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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSMENT*				
BTAU401	DCS	FLUID MECHANICS AND MACHINERY	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 20 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

Fluid Properties & Statics: Fluid properties, pressure measurement, fluid statics, hydrostatics forces: total pressure, centre of pressure, buoyancy and floatation, meta-centre, stability of submerged and floating bodies.

Unit - II

Fluid Kinematics: Types of flow lines, types of fluid flow, rate of flow or discharge continuity equation, velocity and acceleration, rotation, circulation, velocity potential function and stream function, uniform flow, source flow, sink flow, free vortex flow, flow net.

Fluid Dynamics: Forces acting on fluid, Euler's equation, Bernoulli's equation, Impulse-momentum principle, moment of momentum equation, flow measurement: venturimeter, orifice-meter, flow through orifice, mouthpiece etc.

Unit - III

Dimensional Analysis: Introduction, secondary or derived quantities, methods of dimensional analysis, model analysis, similitude-types of similarities, dimensionless numbers, models law.

Pipe Flow: Fully developed pipe flow, viscous through circular pipes (Hagen Poiseuille), turbulent flows: friction factor and Darcy-Weisbach relation, minor and major energy losses.

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Unit-IV

Boundary Layer Theory: Introduction, development of boundary layers over a flat plate, boundary layer thickness, displacement, momentum and energy thicknesses, drag force on flat plate, turbulent boundary layer, separation of boundary layer and its prevention, streamlined and bluff bodies, drag and lift forces.

Unit-V

Fluid machines and Systems: Introduction, various elements of hydraulic system, hydraulic press, hydraulic accumulator, hydraulic intensifier, hydraulic lift, hydraulic ram, hydraulic crane, hydraulic coupling, hydraulic torque converter, types of pumps and their applications, types of turbines and their applications.

Reference Books:

1. *"Fluid Mechanics and Fluid Power Engineering", by D.S. Kumar, S.K. Kataria & Sons*
2. *"Fluid Mechanics and Hydraulic Machines", by R.K. Bansal, Laxmi Publications*
3. *"Fluid Mechanics and Hydraulic Machines", by R.K. Rajput, S. Chand & Co.*
4. *"Fluid Mechanics", by Frank. M. White, McGraw Hill Publishing Company Ltd.*
5. *"Fundamentals of Fluid Mechanics", by Munson, Wiley India Pvt. Ltd*
6. *"Fluid Mechanics by A. K. Mohanty", PHI Learning Pvt. Ltd.*
7. *" Laboratory Manual Hydraulics and Hydraulic Machines", by R V Raikar, PHI Learning Pvt. Ltd.*

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 determine the losses across the fittings in a pipe.
9. To study various hydraulic systems.
10. To study various pumps and turbines.

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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT*				
BTAU402	DCS	THEORY OF MECHANISMS AND 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 20 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.

Course Outcomes (COs):

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

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 do the velocity and acceleration analysis of simple mechanisms.
3. Students will be able to explain effectively present written, oral, and graphical solutions to design problems & develop ability to come up with innovative ideas and design a layout of cam for specified motion.
4. Students will be able demonstrate an understanding of principle of gears.
5. Students will be able to synthesis simple gyroscopic forces and couple, and gyroscopic effect in airplanes, ship and vehicle.

Syllabus

Unit - I

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.

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Unit - II

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

Unit - III

Cams: Classification of Cams and Followers, Radial Cam Terminology, Analysis of Follower motion (uniform, modified uniform, simple harmonic, parabolic, cycloidal), Pressure Angle, Radius of Curvature, Cam Profile for radial and offset followers Synthesis of Cam Profile by Graphical Approach.

Unit - IV

Gears: 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.

Gear Trains: Simple, compound, reverted and epi-cyclic gear trains. Velocity ratio and torque calculation in gear trains

Unit - V

Gyroscope: Gyroscopic Action in Machines, Angular Velocity and Acceleration, Gyroscopic torque/ couple, Gyroscopic effect on Naval Ships, Stability of Two and Four Wheel Vehicles, Rigid disc at an angle fixed to a rotating shaft.

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*
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*

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.

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6. To draw Involutes profile of a gear by generating method.
7. To find out velocity ratio of various gear trains.
8. To study working of sun and planet epicycle gear train mechanism using models
9. To study various types of belt drives & find out the velocity ratio of the drive.
10. To finds out gyroscopic couple.

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SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUTION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT*				
BTAU403	DCS	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 20 marks.

Course Educational Objectives (CEOs)

This course provides a fundamental understanding (A) Toimpart 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. Demonstrate the working of IC engines.
2. Describe the fuel injection and ignition system.
3. Explain the fuel combustion within IC engine.
4. Understand the cooling and lubrication system.
5. Evaluate Engine performance.

Syllabus

Unit - I

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

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

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Fuel Injection System: Functional requirements of an injection system, types of inject systems, components of injection system.
Ignition System: Requirements of ignition system, battery ignition system, magneto ignition system, electronic ignition system, firing order, ignition timing.

Unit - III
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
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
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.

Reference Books:

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

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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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SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT*				
BTAU404	DCS	MACHINE COMPONENT DESIGN	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 20 marks.

Course Educational Objectives (CEOs):

(A) To understand the design methodology for machine elements.
(B) To analyse the forces acting on a machine element,
(C) Apply suitable design methodology.
(D) To understand the various standards and methods of standardization.
(E) 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

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

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.

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Unit -III

Shafts, keys and couplings: Shafts design on strength basis, torsional rigidity basis, ASME codes for shafts, Keys and cotter design, Flat and square keys, Splines, Rigid and flange couplings, Flexible couplings.

Unit -IV

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

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.

Reference Books:

1. *"Design of Machine elements", by Bhandari. V.B. (2010) Tata Mc Graw Hill Book Co, Third Edition.*
2. *"Machine Design", by R.S. Khurmi, J. K. Gupta. (2008) Eurasia Publishing House (Pvt.) Ltd.Revised Edition.*
3. *"Machine Design", by Shingley J.E, TMH.*
4. *"Design of Machine elements", by Sharma and Purohit; PHI.*
5. *"Machine Design", by Wentzell Timothy H, Cengage learning.*
6. *"Machine Design", by Mubeen; Khanna Publisher.*
7. *"Design of Machine Elements", by Ganesh Babu K and Srithar k, TMH.*
8. *"Machine Design", by Sharma & Agrawal; Kataria & sons.*

List of Experiments (Please Expand it):

Solve various design problems as per the syllabus.

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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT*				
BTAU405	DCS	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 20 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

Components of chassis & body, components of automotive suspension system, components of steering system and steering mechanisms, components of transmission system, gear-box, differential systems, 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 various components of suspension system.
5. Describe various components of electrical and control system.
6. Describe various components of emission & pollution control system.
7. Describe the function of gear box and differential.

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