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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*
BTAU601	DCS	AUTOMOTIVE CHASSIS SYSTEM	3	0	2	4	60	20	20	30	20

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):

All automobiles have important driveline and structural components. This subject deals with the functions and constructional details of all the chassis components.

Course Outcomes (COs):

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

1. Dismantle and assemble the automobile chassis and Engine components.
2. Understand working of braking, steering, clutch, transmission, Suspension systems.
3. Differentiate various subsystems of two, three & Four-wheeler vehicles.

Syllabus

Unit- I

Automotive Chassis : Definition; chassis layout; types of chassis layout with reference to power plant location and drive on wheels; chassis components; chassis classification; Automotive frames: Construction; functions; Loads acting on vehicle frame and materials for frames; frame cross sections; frame diagnosis and service; dimensions of wheel base; wheel track; chassis overhang.

Unit – II

Front Axle & Steering System: Functions, construction & Types of Front Axles and Stub Axles; Ackerman's Steering Mechanisms; Steering linkages & layout; Types of steering gear boxes; Power assisted steering; Electronic steering; Four-wheel steering, Front wheel Geometry namely- Castor, Camber, Kingpin inclination, toe-in and toe-out, Condition for true rolling motion, center point steering, directional stability of vehicles, under-steer, over-steer.

Unit – III

Suspension System: Need for Suspension System; Types of Suspension Springs, Constructional details and characteristics of Single Leaf, Multi–Leaf, Coil, Torsion bar; Independent Suspension, Pneumatic suspension; Hydraulic suspension; Shock Absorbers -liquid & gas filled and Constructional details.

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Unit – IV

Braking System: Principle of braking; classification; brake actuating mechanisms; Drum brake- theory; principle; construction; working; Disc brake- theory, principle, construction, working; Parking brake- theory, principle; construction, Stopping Distance Time and Braking Efficiency, Effect of weight transfer during braking, self-energing brake, Hydraulic Braking, Mechanical Braking, Pneumatic Braking, Power–Assisted Braking- theory, vacuum-booster basics, hydraulic-booster basics, Anti–Lock braking system, Exhaust brake.

Unit- V

Wheel & Tyre: Different types of wheels and rims and their constructional details; Forces acting on wheels, construction of wheel assembly, types- spoke, disc & built up wheels;

Tyres: Different Types of Tyres and their constructional details, tyre specifications and material properties of tyres & tubes, Static & rolling properties of tyres, types of tyre-wear & their causes; tyre rotation.

Text Books:

1. "Automobile Engineering Vol.-1" by Kripal Singh, Standard Publishers, 2000.
2. "A Text–Book of Automobile Engineering" by R.K. Rajput, Laxmi Publications Private Limited, 2014.
3. "Automotive Mechanics" by N. K. Giri, Khanna Publishers, New Delhi, 2005.
4. "Automotive Chassis" by Heldt. P. M.- Chilton Co., New York- 1990
5. "Automobile Engineering" by K. K. Ramalingam Scitech Publication, Chennai - 2001.

References Books:

1. "Mechanics of Road Vehicles" by Steed W - Illiffe Books Ltd., London- 1960
2. "Motor Vehicles", by Newton Steeds and Garrot- Butterworths, London- 2000.
3. "Mechanism of the Car", by Judge A.W Chapman and Halls Ltd., London- 1986
4. "Steering, Suspension and tyres", by Giles.J.G- Iiiffe Book Co., London- 1988.
5. "Automotive Chassis and Body", by Crouse W.H- McGraw-Hill, New York- 1971.

List of Experiments:

1. Study of types of chassis layouts.
2. Study and Construction of front axle
3. Study and Construction of steering linkages.
4. Study and Construction of rigid axle suspension system.
5. Study and Construction of independent suspension system.
6. Study and Construction of disc & drum brake assemblies.

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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*
BTAU602(1)	DES	ALTERNATIVE FUELS AND POLLUTION CONTROL	3	0	0	3	60	20	20	0	0

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 Objectives:-

The primary objective of the course is to describe the (A) Alternative fuels and renewable sources of energy (B) Pollutants exhausted from automobiles, (C) Pollution Control Techniques and its Testing.

Course Outcomes:-

After completion of this course the students will be able to describe the followings:

1. Students will be able to understand alternative fuels and its availability for Automobiles.
2. Students will be able to understand and describe renewable energy sources used in automobiles.
3. Students will be able to describe various pollutants and emission standards.
4. Students will be able to understand the pollution control techniques and their testing.

Syllabus

Unit-I

Introduction:

Alternate fuels for automobiles and renewable sources of energy in automobile field: - availabilities, Storage, Handling and Safety aspects- Costs and other factors.

Unit-II

Alternate Fuels:

Alcohols, CNG, LPG, vegetable oils, Hydrogen & Biogas properties performance and Emission characteristics; Solid fuels coal and wood Ash fusibility test; Modification requited use of Alternate fuels in SI and CI engines- Combustion equation; conversion of gravimetric to volumetric analysis flue gas analysis.

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Unit-III

Renewable Sources of Energies:

Introduction about the solar energy collectors- Concentrating, Flat plate collector's application; wind energy-Bio energy; Geo thermal energy- Chemical energy; Fuel cells, Batteries; Hydrogen energies-Energy conservations in sterling and heat pumps.

Unit-IV:

Pollutants: Four Stroke (SI and CI) Engines, Two Stroke (SI and CI) engine; pollution formation; Indian Emission Standards for SI and CI engines; European Emission Standards Comparison with alternate fuel emissions.

Unit-V

Pollution control Techniques and Test procedures:

Optimization of operating factor; EGR Fumigation, Air injection, PCV system (opens Closed); Catalytic Converters, Catalyst use of unleaded petrol; Gas Analyzers-Different Smoke meters-Different test methods; Electric Vehicles Simple layout, Traction batteries, Re-charging methods, rating pollution factors, Fuel Cells.

Reference Book:

1. *"Internal Combustion Engines" by Ganeshan –Tata McGraw Hill, 2008.*
2. *"Internal Combustion Engines" by Heywood John-- McGraw Hill, 2018.*
3. *"Automotive Emission Control" by Crouse and Anglin –McGraw Hill, 1977.*
4. *"Non-conventional Energy Sources"by G.D. Rai, Khanna Pub, 1992.*
5. *"Alternative Fuels" by S.S. Thipse, Jaico Publishing House, 2010.*
6. *"Handbook of Alternative Fuel Technologies"by James G. Speight and Sudarshan K. Loyalka, CRC Press, 2007.*
7. *"Internal Combustion Engines" by Ferguseaon, John Wiley & Sons, 2001.*

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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*
BTAU602(2)	DES	ROBOTICS ENGINEERING	3	0	0	3	60	20	20	0	0

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):

(A) Make the students to learn about the basic concepts of robotics. (B) Impart knowledge of drive systems and sensors. (C) Impart knowledge of Kinematics and Dynamics of Robots. (D) Impart knowledge of robotics control, programming and applications.

Course Outcomes (COs):

After completion of this course the students are expected to be able to

1. Student will be able to understand basic concepts of robotics.
2. Student will be able to describe various drive systems and sensors used in robotics.
3. Student will be able to describe Kinematics and Dynamics of Robots.
4. Student will be able to understand robotics control, programming and it's applications

Syllabus

Unit-I

Introduction: Introduction History of robots, Classification of robots; Present status and future trends. Basic components of robotic system; Basic terminology- Accuracy, Repeatability, Resolution, Degree of freedom; Mechanisms and transmission, End effectors, Grippers-different methods of gripping, Mechanical grippers-Slider crank mechanism, Screw type, Rotary actuators, Cam type gripper, Magnetic grippers, Vacuum grippers, Air operated grippers; Specifications of robot.

Unit-II

Drive systems and Sensors: Drive system- hydraulic, pneumatic and electric systems Sensors in robot – Touch sensors, tactile sensor, Proximity and range sensors, Robotic vision sensor, Force sensor, Light sensors, Pressure sensors.

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Unit-III

Kinematics and Dynamics of Robots: 2D, 3D Transformation, Scaling, Rotation, Translation, Homogeneous coordinates, multiple transformation, Simple problems. Matrix representation, Forward and Reverse Kinematics Of Three Degree of Freedom, Homogeneous Transformations, Inverse kinematics of Robot, Robot Arm dynamics, D-H representation of robots, Basics of Trajectory Planning

Unit-IV

Robot Control: Robot controls-Point to point control, Continuous path control, Intelligent robot, Control system for robot joint, Control actions; Feedback devices, Encoder, Resolver, LVDT, Motion Interpolations, Adaptive control.

Unit-V

Programming and Applications: Introduction to Robotic Programming, On-line and off-line programming, programming examples; Robot applications-Material handling, Machine loading and unloading, assembly, Inspection, Welding, Spray painting.

Text Books:

1. *"Industrial Robotics, Technology programming and Applications" by Mikell P Groover, Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, McGraw Hill, 2012.*
2. *"Introduction to Robotics- mechanics and control" by Craig. J. J., Addison- Wesley, 1999.*

Reference Books:

1. *"Robotics Technology and flexible automation" by S.R. Deb, Tata McGraw-Hill Education., 2009*
2. *"Robotics Engineering an Integrated Approach" by Richard D. Klafter, Thomas .A, ChriElewski, Michael Negin, PHI Learning., 2009*
3. *"Engineering foundation of Robotics" by Francis N. Nagy, Andras Siegler, Prentice Hall Inc., 1987.*
4. *"Robotics and Image Processing an Introduction" by P.A. Janaki Raman, Tata McGraw Hill Publishing company Ltd., 1995*
5. *"Kinematic Analysis of Robot manipulators" by Carl D. Crane and Joseph Duffy, Cambridge University press, 2008*
6. *"Robotics control, sensing, vision and intelligence" by Fu. K. S., Gonzalez. R. C. & Lee C.S.G., McGraw Hill Book co, 1987*
7. *"Robots and Manufacturing Automation" by Ray Asfahl. C., John Wiley & Sons Inc., 1985.*

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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*
BTAU602(3)	DES	PRODUCT LIFE CYCLE MANAGEMENT	3	0	0	3	60	20	20	0	0

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 Objectives:-

The primary objective of the course is to describe the (A) need, benefits and components of PLM (B), designing and developing a product, (C) product data management and PLM Strategies, (D) virtual product development tools, (E) Life Cycle Assessment and Life Cycle Cost Analysis.

Course Outcomes:-

After completion of this course the students will be able to describe the followings:

1. Students will be able to understand & describe concepts of PLM and PLM strategies.
2. Students will be able to describe and understand the concepts of product design.
3. Students will be able to manage product data.
4. Students will be able to understand virtual product development tools.
5. Students will be able to do the life cycle assessment and life cycle cost analysis.

Syllabus

Unit-I

Introduction to Product Lifecycle Management (PLM):

Product Lifecycle Management (PLM), Need for PLM, Product Lifecycle Phases; Opportunities of Globalization, Pre-PLM Environment, PLM Paradigm, Importance & Benefits of PLM, Widespread Impact of PLM, Focus and Application; A PLM Project, Starting the PLM Initiative, PLM Applications.

PLM Strategies:

Industrial strategies, elements of strategy and its identification; selection and implementation of PLM; Developing PLM Vision and PLM Strategy; Change management for PLM.

Unit-II

Product Design:

Product Design and Development Process, Engineering Design, Organization and Decomposition in Product Design; Typologies of Design Process Models, Reference Model; Product Design in the Context of the Product Development Process, Relation with the Development Process Planning Phase, Re-

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lation with the Post design Planning Phase; Methodological Evolution in Product Design; Concurrent Engineering, Characteristic Features of Concurrent Engineering, Concurrent Engineering and Life Cycle Approach; New Product Development (NPD) and Strategies, Product Configuration and Variant Management; The Design for X System, Objective Properties and Design for X Tools, Choice of Design for X Tools and Their Use in the Design Process.

Unit-III

Product Data Management (PDM):

Product and Product Data, PDM systems and importance; Components of PDM, Reason for implementing a PDM system, financial justification of PDM, barriers to PDM implementation.

Unit-IV:

Virtual Product Development Tools:

Virtual Product Development Tools for components, machines and manufacturing plants; 3D CAD systems and realistic rendering techniques; Digital mock-up, Model building, Model analysis, Modeling and simulations in Product Design, Examples/Case studies.

Unit-V

Life Cycle Assessment and Life Cycle Cost Analysis:

Properties and Framework of Life Cycle Assessment, Phases of LCA in ISO Standards; Fields of Application and Limitations of Life Cycle Assessment, Cost Analysis and the Life Cycle Approach; General Framework for LCCA; Evolution of Models for Product Life Cycle Cost Analysis.

Environmental Aspects:

Sustainable Development; Design for Environment; Need for Life Cycle Environmental Strategies, Useful Life Extension Strategies, End-of-Life Strategies; Introduction of Environmental Strategies into the Design Process; Life Cycle Environmental Strategies and Considerations for Product Design.

Reference Book:

1. *"Product Lifecycle Management: Driving the next generation of lean thinking" by Michael Grieve, Tata McGraw Hill, 2006.*
2. *"Product Life Cycle Management"by Saaksvuori Antti and Immonen Anselmie, Springer, Dreamtech, 2004.*
3. *"Product Lifecycle Management: Paradigm for 21st Century Product Realisation"by John Stark, Springer-Verlag, 2004.*
4. *"Product Design for the environment-A life cycle approach"by Fabio Giudice, Guido La Rosa and Antonino Risitano, Taylor & Francis, 2006.*
5. *"Environmentally-friendly Product Development Methods and Tools" by Abele E. et al., Springer, 2007.*

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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*
BTAU602(4)	DES	ENTERPRISE RESOURCE PLANNING	3	0	0	3	60	20	20	0	0

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 Objectives:-
The primary objective of the course is to describe the (A) ERP and its implementation (B) ERP Modules (C) ERP integration and E-Business (D) Resource Management.

Course Outcomes:-
After completion of this course the students will be able to describe the followings:

1. Students will be able to understand ERP concepts.
2. Students will be able to understand ERP implementation and its constraints.
3. Students will be able to describe the various ERP modules.
4. Students will be able to understand integration and E-business.
5. Students will be able to understand the resource management.

Syllabus

Unit-I
Introduction:
Evolutionary stages of Enterprise Resource Planning (ERP); Need for ERP, Variety accommodation, Strategic and operational issues in ERP; Integrated and Business model of ERP; Online analytical processing (OLAP).

Unit-II
ERP Implementation:
Introduction to Business Process Re-Engineering (BPR), ERP Implementation: Role of consultants, vendors and users, Guidelines and Procedure for ERP implementation, strategic advantage through ERP, ERP Domain.

Unit-III
ERP Modules:
Business module in ERP, Finance, Manufacturing, Human resources, Plant maintenance, Materials management, Quality management, Sales and Distribution.

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Unit-IV:

Integration & E-Business:

Turbo Charge the ERP System, Enterprise Integration Applications (EIA), ERP and E–Commerce; ERP and internet; Future of ERP, E-Procurement, E-Governance, Developing the E-Business Design.

Unit-V

Resource Management:

Resource Management, ERP – A Manufacturing perspective, ERP Case studies with applications and uses of software; E- business components and interrelationship, Integrated data model, Information Technology and computer net work support to MIS.

Reference Book:

1. *"Enterprise Resource Planning, Concept and Practice" by V.K. Garg and N.K. Venkitkrishnan, PHI, 2003.*
2. *"Enterprise Resource Planning" by -Alexis Leon, Tata McGraw Hill, 2008.*
3. *"Enterprise Resource Planning –Diversified" by Alexis Leon, TMH, 2014.*
4. *"Enterprise Resource Planning" by Ravi Shankar & S. Jaiswal, Galgotia, 2000.*
5. *"Business Process Re-Engineering"by Jayaraman, , TMH, 1994.*
6. *"Guide to Planning ERP Application" by, Annetta Clewwto and Dane Franklin, McGRaw-Hill,1997.*

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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*
BTAU603	DCS	VIBRATION AND NOISE CONTROL IN AUTOMOBILES	3	1	2	5	60	20	20	30	20

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 of (A) Vibration and noise in automobiles
(B) Design modifications to reduce the vibration and noise(C) Improve the life of components.

Course Outcomes (COs)
After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

1. Understand free and forced vibrations of single degree freedom systems.
2. Analyze balancing problems in rotating and reciprocating machinery.
3. Understanding causes, source and types of vibrations in machineries.
4. Gaining knowledge in sources and measurement standard of noise.
5. Ability to design and develop vibrations and noise control systems.

Syllabus

Unit - I

Fundamental Aspects of Vibrations: Definition of Vibration, main causes, advantages and disadvantages; engineering applications of vibration and noise; vector method of representing harmonic motion; characteristics of vibration, harmonic analysis and beats phenomenon, work done by harmonic forces on harmonic motion; periodic, non-harmonic functions- Fourier series analysis; evaluation of coefficients of Fourier series; elements of vibratory system; lumped and distributed parameter systems.

Un-damped Free Vibrations: Derivation of differential equation of motion: the energy method, the method based on Newton's second law of motion, and Rayleigh's method. Solution of differential equation of motion: Natural frequency of vibration. Systems involving angular oscillations: compound pendulum.

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Unit - II

Damped Free Vibrations: Viscous damping: coefficient of damping; damping ratio; under damped, over damped and critically damped systems; logarithmic decrement; frequency of damped free vibration; Coulomb or dry friction damping; frequency, decay rate and comparison of viscous and Coulomb damping; solid and structural damping; slip or interfacial damping.

Unit - III

Harmonically excited Vibration: One degree of freedom, forced harmonic vibration vector representation of forces; excitation due to rotating and reciprocating unbalance; vibration Isolation, force and motion transmissibility; absolute and relative motion of mass (Seismic Instruments).

Whirling Motion and Critical Speed: Whirling motion and Critical speed: Definitions and significance. Critical speed of a vertical, light flexible shaft with single rotor: with and without damping .Critical speed of a shaft carrying multiple discs (without damping), Secondary critical speed.

Unit – IV

Systems With Two Degrees of Freedom : Un-damped free vibration of 2 d.o.f and Principal modes of vibration; torsion vibrations; Forced, Un-damped vibrations with harmonic excitation ; Coordinate coupling; Dynamic vibration absorber; torsion Vibration Absorber; Pendulum type of dynamic vibration.

Unit-V

Noise Measurement & Control : Noise and its causes, sound pressure / intensity / power level and their inter-relation, Decibel scale, Loudness and equal loudness contours, Effect of machine / process noise on operators, employees and local residents. Standards of noise level and exposure limit, Methods of industrial noise control, Measurement of noise, Sound spectra and octave band analysis. Background noise, weighted networks,

Reference Books:

1. *"Mechanical Vibrations and Noise Engineering" by Ambekar A.G, PHI, 2006.*
2. *"Element of Vibration Analysis" by Meirovitch Leonard , TMH, 2010.*
3. *"Text book of Mechanical Vibrations" by Dukikipati RV Srinivas J, PHI, 2013.*
4. *"Mechanical Vibrations" by Kelly SG and kudari SK, Schaum Series, TMH, 2012.*
5. *"Theory of Vibration with Applications" by Thomson, W.T, C.B.S Pub & distributors, 2002.*

List of Experiments

1. To find out effect of load on natural frequency of vibrations of a lever pin supported at one end carrying adjustable load on a vertical screwed bar and spring supported at some

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intermediate point (i) When the dead weight of rods is neglected and (ii) when their dead weight is taken into account

2. To find out frequency of damped free vibration and rate of decay of vibration-amplitude in the system
3. To find out natural frequency and damped free frequency of a torsion pendulum and, hence to find out coefficient of damping of the oil
4. To observe the phenomenon of ' whirl' in a horizontal light shaft and to determine the critical speed of the shaft
5. To observe the mode shapes of a spring-connected, double pendulum and hence to demonstrate the phenomenon of beats.
6. To demonstrate the principle of tuned Un-damped Dynamic Vibration Absorber and to determine the effect of mass-ratio (of main and auxiliary mass) on the spread of the resulting Natural frequencies
7. To take measurements of sound Pressure Level (SPL) and to carry out octave band analysis of a machine using Noise Level Meter

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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*
BTAU604	DCS	VEHICLE BODY ENGINEERING	3	0	2	4	60	20	20	30	20

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 present a problem oriented in depth

Knowledge of automobile chassis and body engineering (B) to address the underlying concepts and methods used for automobile chassis and body engineering.

Course Outcomes (COs)

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

1. Understand and have knowledge about different aspects related to body and chassis.
2. Understand various safety provisions.
3. Design the chassis and able to select the section of same.
4. Design the cabin and frame component to transfer the force and optimize from safety and cost point of view.

Syllabus

Unit-I

Vehicle Chassis: Introduction, Chassis frame operating and design considerations; Chassis frame components, sections used; Types of joints; Types of chassis frame; Vehicle components location and attachment.

Unit-II

Car Body: Classification of vehicle based on body types; Types of car bodies, Integral body construction details: Requirements of body, Loads on the vehicle body: Static load, Acceleration and Braking, Moments and Torque due to driving conditions (torsion and bending moments); Types of materials used in body construction, Analysis and Selection of body member sections; Body sub frame and under floor structure, car front and rear end structure; Vehicle Structure Analysis by Simple Structural Surface (SSS) Method: Saloon and simple van.
Crashworthiness: features and requirements for occupant protections crumple zones; Description

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of Body zones/assemblies/components, Body trims, Engine, transmission and body structure mounting;

Unit-III

Bus Body and Commercial Vehicle body: Classification of bus bodies-Based on distance traveled, Based on capacity of the bus and based on style & shape. Types of metal section used in the construction and regulations; Construction of conventional and integral type buses and comparison; Classification of commercial vehicle bodies. Construction of Tanker body and Tipper body, Driver cabin design for compactness Design of frames for bus and commercial vehicles

Unit-IV

Ergonomic: Introduction of ergonomics; anthropometric dimensions of standard occupant; Concept of H-point referencing, interior design for ergonomics and comfort, seat design for ride comfort, suspension seats, split frame seating, back passion reducers; dash board instruments, pedal controls and electronic displays; Driver seat design of bus body and commercial vehicle body.

Unit-V

Vehicle Safety: Safety aspects in design, Types of safety (Active and Passive), Safety features: overview of requirement for occupant protection (frontal, side, rear and rollover impact) and pedestrian safety, Airbags and Seatbelts; Visibility: Regulation, Driver's visibility, Methods of improving visibility, Introduction of crash test, Chassis and body alignment test.

Reference Books:

1. *"Vehicle Body Engineering", by Jnusz Pawlowski, Publisher: Business books limited, 1970.*
2. *"An Introduction to Modern Vehicle Design", by J H Smith Publisher: Butterworth-Heinemann, 2001.*
3. *"Motor Vehicle Structure: Concepts and Fundamentals'', by J Brown, A J Roberstson, S Serphento, Publisher: Butterworth-Heinemann, 2002.*
4. *"Advanced Vehicle Technology", by Heinz Heizler, Publisher: Butterworth-, London, 2002.*
5. *"Automobile Engineering :Power train, chassis system and vehicle body", by David A Crolla, Publisher: Elsevie, 2009.*
6. *"Ergonomics in Automotive Design", by V D Bhinse, Publisher: CRC Press, 2011.*
7. *"Handbook of Automotive Body and Systems Design", by John Fenton Publisher: Wiley India, 2013.*
8. *"Handbook of Automotive Body Construction and Design Analysis", by John Fenton, Publisher: Wiley India, 1998.*

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List of Experiment

1. Study of Development and construction of vehicle body
2. Study of body repairing tools and shop equipment.
3. Study of minor body Repairing work.
4. Study of major body Repairing work.
5. Study of glass and door fitting and Repairing work process.
6. Study of various body materials.
7. Study of various types of car bodies.
8. Study different types of bus and commercial vehicle body.
9. Study the ergonomics associated with automobile body design.
10. Study of vehicle safety aspects and safety features.

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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*
BTAU605	DCS	AUTOMOTIVE COMPONENT DESIGN	3	1	2	5	60	20	20	30	20

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 make the students understand (A)the design concept and principles of various engine Components(B) Selection of proper material for engine components (C) Developing the ability to analyze problem, weight alternatives and find the suitable solution

Course Outcomes (COs):

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

1. Students would be able to understand the fundamental aspect ofDesign.
2. Students will be able to select and design the different automobile components.
3. Students will be able to standardize the different parts.
4. Students will be able to give reasons of assumptions made while designing the component with reference to manufacturing assembly, thermal and wear considerations point of view.

Syllabus

Unit – I

Introduction: Engineering materials and their physical & mechanical properties applied to design; selection of materials, factor of safety, endurance limit, notch sensitivity; principles of design optimization, future trends and computer aided drafting.

Unit – II

Limits, Fits, Tolerances, Surface Finish, Shafts and springs: Definitions, types of tolerances and fits; design considerations for interference fits, surface finish, surface roughness; design of power transmission shafts and design of helical springs.

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Unit – III

Design of Cylinder and Piston: Choice of material for cylinder and piston, piston friction, piston slap; design of cylinder, piston, piston pin, piston rings, piston failures, lubrication of piston assembly.

Unit – IV

Design of Connecting Rod, Crankshaft: Material for connecting rod; determining minimum length of connecting rod, small end and big end design, shank design, design of big end cap bolts; connecting rod failures; balancing of I.C. Engines, significance of firing order; material for crankshaft, design of crankshaft under bending and twisting, balancing weight calculations.

Unit-V

Design of Valves and Flywheel: Design aspects of intake and exhaust manifolds; inlet and Exhaust valves, valve springs, tappets, valve train; Materials and design of flywheel.

Reference Books:

1. *"An Introduction to Modern Vehicle Design" by Julian Happian-Smith, BH, 2001.*
2. *"Automobile Chassis Design and calculations", by P. Lukin, Mir Publishers, 2002.*
3. *"Automotive Mechanics" by N. K. Giri, Khanna Publishers, 1998.*
4. *"Machine Design", by Sadhu singh, Khanna Publishers, 2015.*
5. *"Automobile Chassis Design", by Dean Averns,Lllife Books Ltd., 1992.*
6. *"Automobile Engineering Vol-I & II", by Kirpal Singh, Standard Pub., 2011.*
7. *"Automobile Engineering Vol-I & II" by K.M.Gupta, Umesh Pub., 2001.*
8. *"Mechanical Engineering Design", Fourth Edition, by Joseph E. Shigley& Larry D. Mitchell, McGraw- Hill International Book Company, 1993.*

List of Experiments

1. To standardize the given automobile part for size, torque and power point of view.
2. To design the spur, helical, bevel and worm gear for given situation of automobile vehicle.
3. To design the engine cylinder for given situation of automobile vehicle.
4. To design the piston for given situation of automobile vehicle.
5. To design the flywheel for given situation of automobile vehicle.
6. To design the valve and valve mechanism for given situation of automobile vehicle.
7. To design the connecting rod for given situation of automobile vehicle.
8. To give reason of design.

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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*
BTAU606	DS	SIMULATION OF AUTOMOBILE SYSTEM LAB	0	0	4	2	0	0	0	0	50

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):

(A)Ability to recognize modeling and identification concepts as related to mechanical systems.(B)Make use of modern modeling tools to represent mechanical systems(C)Understand various techniques of simulation(D)Develop the skills of modeling and simulation using various software / programming languages. (E)Apply modeling and simulation techniques to simulate industrial systems using software packages.

Course Outcomes (COs):

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

1. Have knowledge of modeling and simulation using various software / programming languages.
2. Ability to get experience on modeling software's such as CREO.
3. Ability to simulate the physical behavior of systems using ANSYS, MATLAB & Simulink.
4. Ability to analyze results obtained from these simulation tools.

Syllabus

Unit - I

Modeling Basics: Models, modeling purpose, objectives and examples of models

Principles of Physical Modeling: Concept of System and environment; basic relationship, Continuous and discrete systems; Linear and non-linear systems, stochastic activities, Bond Graphs.

Unit - II

Computer Aided Modeling: Solid modeling of component using Creo; finite element modeling using ANSYS; Static and Dynamic models; Estimating Transient Response, Spectra and Frequency Functions, Parameter Estimation in Dynamic Models; System Identification as a Tool for Model Building.

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Unit - III

Basic Simulation Modeling: Role of simulation in model evaluation and studies; advantages of simulation; System Simulation; Techniques of simulation, Monte Carlo method, Experimental nature of simulation, Numerical computation techniques.

Unit - IV

System Simulation and Its Types: Continuous system models; Analog and Hybrid simulation, Feedback systems, Computers in simulation studies, Simulation software packages.
System Dynamics: Growth and Decay models, Logistic curves, System dynamics diagrams.

Unit-V

Simulation of Mechanical Systems: Building of Simulation models, simulation of translational and rotational mechanical systems, Simulation of electro mechanical; thermo - mechanical, hydraulic & pneumatic elements; Case studies related to industrial problems.

Reference Books:

1. *"Advanced Dynamics: Modeling and Analysis", D'Souza, A.F., and Garg, V.K, Prentice-Hall, 1984.*
2. *"Modeling and Simulation with HDL", George Pelz, John Wiley & Sons Ltd., 2003.*
3. *"Modelling Analysis and Control of Dynamic Systems", W.J. Palm, John Wiley, 1983.*
4. *"Getting Started with MATLAB",Rudra Pratap, "Oxford University Press, 2006.*
5. *"Modeling of Dynamic Systems" Lennart, L. and Torkel, G., Prentice Hall, 2018.*
6. *"Mathematical Modeling for Design of Machine Components" Bhonsle, S.R., and Weinmann, K.J., Prentice Hall, 1999.*
7. *"Bond Graph in Modeling, Simulation and Fault Identification", Mukherjee, A., Karmaker, R. and Samantaray, A.K., I & K International, 2006.*
8. *"Systems Modelling & Analysis", I.J. Nagarath & M. Gopal, Tata McGraw Hill, 2003.*

List of Experiments

1. Introduction to CAD(CREO) and FEM analysis software package(Ansys)
2. Solid modeling of structural components using CREO.
3. Introduction to 2D and 3D Meshing.
4. Finite element analysis of structural component using ANSYS.
5. Static structural analysis g of machine component using ANSYS.
6. Mode analysis of machine component using ANSYS
7. Nonlinear structural analysis using ANSYS.
8. Static and transient thermal analysis using ANSYS.
9. Transient analysis of vibrating system ANSYS.
10. Introduction to durability analysis of Mechanical component using ANSYS.
11. Introduction to rigid body dynamic analysis using ANSYS.
12. Introduction to Topology optimization and Structure/Weight Optimization.
13. MATLAB tutorial for simulation of various mechanical systems.

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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*
BTEE608	ODS	AUTOMOTIVE ELECTRICAL AND ELECTRONICS LAB	0	0	2	1	0	0	0	0	50

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 of (A) Batteries and Accessories, System Engineering(B)Charging System and Fundamentals of Automotive Electronics (C)Sensors and Activators.

Course Outcomes (COs):

After learning the course the students should be able to:

1. Understand and use a voltage/amperes tester to test and diagnose problems in the automobile battery, starting, and charging systems
2. Understand the application of Sensors and Activators used in automobile system.

Syllabus

Unit-I

Batteries and Accessories: Principle and construction of lead acid battery; characteristics of battery, rating capacity and efficiency of batteries, various tests on batteries; maintenance and charging.

Lighting system: insulated and earth return system, details of head light and side light, LED lighting system, head light dazzling and preventive methods Horn, wiper system and trafficator.

Unit-II

System Engineering: Condition at starting, behavior of starter during starting, series motor and its characteristics; principle and construction of starter motor, working of different starter drive units, care and maintenances of starter motor, starter switches.

Unit-III

Charging System: Generation of direct current, shunt generator characteristics, armature

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reaction, third brush regulation, cutout. Voltage and current regulators, compensated voltage regulator, alternators principle and constructional aspects and bridge rectifiers, new developments.

Unit-IV

Fundamentals of Automotive Electronics: Current trends in automotive electronic engine management system; electro-magnetic interference suppression, electromagnetic compatibility, electronic dashboard instruments, onboard diagnostic system, security and warning system

Unit-V

Sensors and Activators: Types of sensors: sensor for speed, throttle position, exhaust oxygen level, manifold pressure, crankshaft position, coolant temperature, exhaust temperature, air mass flow for engine application. Solenoids, stepper motors, relay.

Reference Books:

1. *"Understanding Automotive Electronics" by Bechhold Publisher SAE, 1998.*
2. *"Automobile Electrical Equipment" by Crouse W.H, Publisher: McGraw-Hill Book Co., Inc., New York, 3rd edition, 1986.*
3. *"Modern Electrical Equipment of Automobiles" by Judge A.W ", Publisher: Chapman & Hall, London, 1992.*
4. *"Automotive Electrical Equipment" by Kholi.P.L Publisher: Tata McGraw-Hill Co., Ltd., New Delhi, 1975.*
5. *"Automotive Hand Book" by Robert Bosch Publisher: SAE (5th Edition), 2000.*
6. *"Internal Combustion Engines" by Ganesan.V. Publisher: Tata McGraw-Hill Publishing Co., New Delhi, 2003.*

List of Experiments:

A. Electrical Laboratory

1. Testing of batteries and battery maintenance
2. Testing of starting motors and Alternators
3. Testing of regulators and cut – outs relay
4. Diagnosis of ignition system faults
5. Study of automobile electrical wiring

B. Electronics Laboratory

1. Throttle Position Sensor
2. Lambda Sensor
3. Interfacing of analog sensors with micro-controller
4. Interfacing of frequency input from speed sensor to microcontroller
5. Study of Engine Management System
6. Study of Antilock Braking System

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