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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*				
BTAU601	DCS	AUTOMOTIVE CHASSIS SYSTEM	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):

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

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Suspension, Pneumatic suspension; Hydraulic suspension, Shock Absorbers -liquid & gas filled and Constructional details,.

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 :, Types and Constructional Details of Different Types of Wheels and Rims, 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" by Kripal Singh.
2. "A Text–Book of Automobile Engineering", by R.K. Rajput, Laxmi Publications Private Limited
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	TEACHER ASSESSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT*				
BTAU612	DES	INTRODUCTION TO FINITE ELEMENT METHODS	60	20	20	0	0	3	0	0	3

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 familiarize students with the displacement-based finite element method for displacement and stress analysis and to introduce related analytical and computer tools. (B)To provides a bridge between hand calculations based on mechanics of materials and machine design and numerical solutions for more complex geometries and loading states. (C)To study approximate nature of the finite element method and convergence of results are examined.

Course Outcomes (COs)

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

1. Introduction to Engineering Analysis tool FEA its application in Linear static Analysis and 2D problems
2. Study of Finite Element modeling and simulation Techniques
3. Use of FEA in structural vibration and thermal Analysis
4. Study of Finite Element Software - ANSYS

Syllabus

Unit - I

Basics of FEM: Basic concept of Finite Element Method, Historical background, FEM Applications, General Description of FEM, Commercial FEM software packages, Spring element-stiffness matrix, boundary conditions, solving equations, Variation formulation approach- Rayleigh-Ritz method, Principle of minimum Potential Energy, Weighted residual methods. Initial value and boundary value problems, weighted residual Galerkin and Raleigh Ritz methods-review of Variation calculus, Integration by parts, Basics of variation formulation.

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Unit - II

Element Types and Characteristics: Discretization of the domain, Basic element shapes, Aspect ratio, Shape functions, Generalized co-ordinates and nodal shape functions; ID bar and beam elements, 2D rectangular and triangular elements; axis-symmetric elements.

Unit – III

Assembly of Elements and Matrices : Concept of element assembly, Global and local coordinate systems, Band width and its effects, Banded and skyline assembly, Boundary conditions, Solution of simultaneous equations, Gaussian elimination and Chloe's decomposition methods, Numerical integration, One and 2D applications

Unit - IV

Higher Order and Iso-parametric Elements: One dimensional quadratic and cubic elements, Use of natural co-ordinate system, Area co-ordinate system continuity and convergence requirements, 2D rectangular and triangular requirement.

Unit-V

Structural Vibration and Dynamic Analysis: Review of basic dynamic equations, Hamilton's principle, element mass matrices, free vibration (normal mode) analysis, Eigen values and Eigen vectors, Introduction to transient response analysis.

Reference Books:

1. *"Finite elements in Engineering", by Chandrupatla&Belagundu Prentice Hall of India Private Ltd., 1997.*
2. *"Finite Element Method in Engineering", by Rao S.S. Pregamon Press, 1989.*
3. *"Finite Element Analysis- Theory and Programming", Krishnamoorthy. C.S., Tata McGraw-Hill Publishing Co., 1987.*
4. *"An introduction to the Finite Element Method", by Reddy, J.N. McGraw Hill Book Company New York; 1984.*
5. *"The Finite Element Method in Engg. Science", by Zienkiewicz. O.C McGraw-Hill, London, 1977.*
6. *"Concepts and Applications of Finite Element Analysis", by Cook, Robert Davis ET all Willy, John & Sons, 1999.*
7. *"The Finite Element Method for Engineers", byHubner. K.H., Donald. L.D, D.E. Smith, Ted G.Byron John, Willy & Sons, 1982.*

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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*				
BTAU622	DES	RESOURCE MANAGEMENT TECHNIQUES	60	20	20	0	0	3	0	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit;
Q/A – Quiz/Assignment/Attendance, MST Mid Sem Test.
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class,

Course Educational Objectives (CEOs):

To introduction with (A) the student should be made able to be familiar with resource management techniques. Learn to solve problems in linear programming and Integer programming.(B)The student should be made able to introduce methods of optimization to engineering students, network flow algorithms, CPM and PERT.(C)The student should be made able to understand interior point methods, quadratic programming, nonlinear programming, and heuristic methods.

Course Outcomes (COs):

Upon successful completion of this course, the student will be able to understand:

1. Basic theoretical principles in optimization techniques
2. Formulation of optimization models
3. Solution methods in optimization using simplex method.
4. Apply integer programming and linear programming to solve real-life applications.
5. Methods of sensitivity analysis
6. Applications to a wide range of engineering problems PERT and CPM for problems in project management

Syllabus

Unit-I

Linear programming - Principal components of decision problem, Modeling phases ,LP Formulation and graphic solution, introduction to duality theory, Simplexmethod, big M method, Definition of dual problem- Primal, Dualrelationships- Dual simplex methods, Two-phase method, Sensitivity analysis.

Unit-II

Resource allocation Problem: Transportation & assignment models, Mathematical model for Transportation problem, balanced and unbalanced problem -Assignment problem, Shortest route Problem.

Unit-III

Integer Programming - Cutting plan algorithm - Branch and bound methods, Multistage (Dynamic) programming.

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Unit-IV

Classical OptimizationTheory: Unconstrained external problems, Newton Raphson method, Equality constraints - Jacobean methods, Lagrangian method, Kuhn Tucker conditions - Simple problems.

Unit-V

Project Evaluation: Projectscheduling, projectnetwork, determination of critical path, project duration andslack time calculation, Cost considerations in project scheduling, Time charts and resource leveling -PERT, Critical path method

Text Book:

1. "Operation Research", by H.A. Taha, Prentice Hall of India, 2002.

References Books:

1. *"Problems on operations research", by Gupta and Hira, S.Chand & Company, New Delhi, 1991.*
2. *"Operations Research, Panneerselvam", by R, Prentice – Hall of India, New Delhi, 2002.*
3. *"Quantitative Methods for Business", Anderson '8th Edition, Thomson Learning, 2002.*
4. *"Quantitative Techniques in Management", by Tata Vohra, Mc Graw Hill, 2002.*
5. *"Operation Research", by Anand Sarma, Himalaya Publishing House, 2003.*

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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*				
BTAU632	DES	ROBOTICS & MACHINE VISION SYSTEM	60	20	20	0	0	3	0	0	3

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) Make the students to learn about the mechanical design of robots, various sensors and its application in the area of industrial robotics. (B) Impart knowledge in the area of mechanical design, sensors and programming of industrial robots. (C) Expose students to various applications of vision and challenges involved in each. (D) Impart knowledge on imaging, machine vision and its applications.

Course Outcomes (COs):

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

1. Explain the various image processing and image analysis algorithms and the issues involved in applying them to various machine vision applications
2. Apply the basic concepts of optics in imaging.
3. Explain the various hardware components of an imaging system for machine vision applications.

Syllabus

Unit-I

Introduction: Types of Industrial Robots, definitions – classifications based on work envelope – Generations configurations and control loops, co-ordinate system – need for robot – basic parts and functions –specifications. Robot motion – Kinematics of Robot motion – Direct and Indirect kinematics Homogeneous transformations – linkages and joints – mechanism – method for location and orientation of objects –drive systems – end effectors – types, selection, classification and design of grippers – gripper force analysis. Functions of Sensors – Position and proximity's sensing – tactile sensing – sensing joint forces – vision system – object recognition and image transformation – safety monitoring sensor systems – image analysis – application of image processing.

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Unit-II

Robot Programming & AI Techniques: Types of Programming, Teach pendant programming, Basic concepts in A1 techniques, Concept of knowledge representations, Expert system and its components. Robotic cell layouts, Inter locks – Humanoid robots, Microrobots, Application of robots in surgery, Manufacturing industries, space and underwater.

Unit-III

Image Acquisition: Human vision – Machine and Computer vision – Benefits, Block diagram and function. System implementation of industrial machine vision system. Light – Physics and Interactions, Refraction at a spherical surface – Thin Lens EquationScene constraints – Lighting parameters – Lighting sources, Selection – Lighting Techniques – Types and Selection – Machine Vision Lenses and Optical Filters, Specifications and Selection – Imaging Sensors – CCD and CMOS, Specifications – Interface Architectures – Analog and Digital Cameras – Digital Camera Interfaces – Camera Computer Interfaces, Specifications and Selection – Geometrical Image formation models – Camera Calibration

Unit-IV

Image Processing: Machine Vision Software, Fundamentals of Digital Image, Image Acquisition Modes – Image Processing in Spatial and Frequency Domain – Point Operation, Thresholding, Grayscale Stretching – Neighborhood Operations, Image Smoothing and Sharpening – Edge Detection – Binary Morphology – Color image processing

Unit-V

Machine Vision Analysis & Applications: Feature extraction – Region Features, Shape and Size features, Texture Analysis, TemplateMatching and Classification – 3D Machine Vision Techniques, Decision Making.Machine vision applications in manufacturing, electronics, printing, pharmaceutical, textile,applications in non-visible spectrum, metrology and gauging,OCR and OCV, vision guided robotics – Field and Service Applications – Agricultural, and Bio medical field, augmented reality, surveillance, bio-metrics.

Text Books:

1. "Robotics and Image Processing",byJanakiraman P.A. Tata McGraw Hill
2. "Introduction to Robotics , analyses , systems, applications", by Saeed B.Niku , Prentice Hall Pvt Ltd
3. "Robotics", by YoramKoren , McGraw Hill
4. "Optics", by Eugene Hecht, A.R. Ganesan
5. "Handbook of Machine Vision", by Alexander Hornberg,

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Reference Books:

1. "Industrial Robotics, technology, programming and application", by Groover.M.P. Mc-Graw Hill book and co. 2012
2. "Robotics Control, sensing, vision and intelligence", by Fu.K.S ,Gonzalac R.C ,Lee C.S.G, Mc- Graw Hill book co 2011.
3. "Introductory Techniques For 3D Computer Vision", by EmanueleTrucco, Alessandro Verri, FirstEdition, 2009
4. "Digital Image Processing Publishers", by Rafael C.Gonzales, Richard.E.Woods, Third Edition, 2007

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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*				
BTAU642	DES	PROCESSING OF MATERIALS	60	20	20	0	0	3	0	0	3

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) Forming, (B) Extrusions (C) Forging and rolling.

Course Outcomes (COs):

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

1. Identify various forming process.
2. Identify and determine various methods rolling processes.
3. Identify and determine various methods to forging processes.
4. Identify and determine various methods to Drawing processes.
5. Identify and determine various methods to Sheet metal forming processes.

Syllabus

Unit – I

Introduction to forming- types, advantages and disadvantages. Typical stress-strain diagram for ductile materials. Forming properties of metals and alloys (yield strength/flow stress, ductility, strain hardening, strain rate sensitivity, effect of temperature and hydrostatic pressure on yield strength), Strain rate effects, work of plastic deformation. Flow stress curves, Super plasticity in materials, hot working and cold working operation, Relative merits and applications.

Unit – II

Forging: Open die and closed die forging, machine forging, upset forging etc., forging loads, forging die design. Estimation of forging loads for rectangular and cylindrical slugs. Forgeability Tests. Defects in forging, forging equipment – constructional features and operation.

Unit – III

Rolling: Principles of rolling, Process parameters, Estimation of rolling loads by consideration of stresses. Principles of roll pass design for various product shapes. Principles of ring rolling.

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Processing maps and their applications in metal working operation. Rolling mills – Their constructional features and operation.

Unit – IV

Extrusion: Classification of extrusion processes, extrusion equipment. Hot extrusion deformation and defects in extrusion. Analysis of the extrusion processes, cold extrusion. Extrusion of tubing and production of seamless pipe and tubing.

Unit-V

Sheet Metal Working: Standard die sets, simple, compound, combination, progressive and transfer dies. Process parameters and estimation of loads in shearing, bending, deep drawing, shear spinning operations. Mechanical and hydraulic presses, relative merits and application – constructional features and operation.

Drawing of Rods, Wires and Tubes: Road and wire drawing, tube drawing process, residual stresses in rod, wire and tubes.

Reference Books:

1. *"An Introduction to the Principles of Metal Working", by Geoffery W. Rowe.*
2. *"Sheet working of Metal", by Eary and Reads.*
3. *"Manufacturing Sciences", by Amitabh Ghosh and Mallik.*
4. *"Manufacturing Technology", by P. N. Rao.*
5. *"Production Engineering ", by Sharma P. C.*
6. *"Fundamentals of Metal Forming Processes", by, Juneja B. L,New Age International Publishers, 2010*
7. *"Metal Working Science and Engineering", by, Mielnik Edward M. McGraw Hill, 1991.*

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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*				
BTAU603	DCS	VIBRATION AND NOISE CONTROL IN AUTOMOBILES	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)

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; Publisher: PHI*
2. *"Element of Vibration Analysis", by Meirovitch Leonard Publisher: TMH*
3. *"Text book of Mechanical Vibrations", by Dukikipati RV Srinivas J; Publisher PHI*
4. *"Mechanical Vibrations", by Kelly SG and kudari SK; Publisher: SchaumSeries;TMH*
5. *"Theory of Vibration with Applications", by Thomson, W.T publisher: C.B.S Pub & distributors.*

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	TEACHER ASSESSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT*				
BTAU604	DCS	VEHICLE BODY ENGINEERING	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)

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 behind 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.

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Crashworthiness: features and requirements for occupant protections crumple zones; Description 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.*
2. *"An Introduction to Modern Vehicle Design", by J H Smith Publisher: Butterworth-Heinemann.*
3. *"Motor Vehicle Structure: Concepts and Fundamentals'', by J Brown, A J Roberstson, S Serphento, Publisher: Butterworth-Heinemann.*
4. *"Advanced Vehicle Technology", by Heinz Heizler, Publisher: Butterworth-, London.*
5. *"Automobile Engineering :Power train, chassis system and vehicle body", by David A Crolla, Publisher: Elsevier*
6. *"Ergonomics in Automotive Design", by V D Bhinse, Publisher: CRC Press.*
7. *"Handbook of Automotive Body and Systems Design", by John Fenton Publisher: Wiley India.*
8. *"Handbook of Automotive Body Construction and Design Analysis", by John Fenton, Publisher: Wiley India.*

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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*				
BTAU605	DCS	AUTOMOTIVE 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):

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 of Design.
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.

Unit – III

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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. *"Elements of Motor Vehicles Design", by D T Bdonkins, TMH*
2. *"Automobile Chassis Design and calculations", by P. Lukin, Mir Publishers*
3. *"Auto design Problems" by K. M. Agrawal, Satya prakashan*
4. *"Automotive Mechanics" by N. K. Giri, Khanna Publishers*
5. *"Machine Design", by Sadhu singh, Khanna Publishers*
6. *"Automobile Chassis Design", by Dean Averns,Lllife Books Ltd (1992)*
7. *"Automobile Engi neering Vol-I & II", by Kirpal Singh, Standard Pub.*
8. *"Automobile Engineering Vol-I & II" by K.M.Gupta, Umesh Pub.*
9. *"Auto Design", by R. B. Gupta, Satya Prakashan*
10. *"Mechanical Engineering Design", Fourth Edition, by Joseph E. Shigley & Larry D.Mitchell, McGraw- Hill International Book Company*

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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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*				
BTAU606	DS	SIMULATION OF AUTOMOBILE SYSTEM LAB	0	0	0	0	20	0	0	4	2

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)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.*
2. *"Modeling and Simulation with HDL", George Pelz, John Wiley & Sons Ltd.*
3. *"Modelling Analysis and Control of Dynamic Systems", W.J. Palm, John Wiley.*
4. *Getting Started with MATLAB",Rudra Pratap, "Oxford University Press.*
5. *"Practical Finite ElementAnalysis" (Finite to infinite), Nitin S.Gokhale, Sanjay S. Despande, Dr. Anand N. Thite."System Simulation", Gordon, G; Prentice Hall.*
6. *"Modeling of Dynamic Systems" Lennart, L. and Torkel, G., Prentice Hall.*
7. *"Mathematical Modeling for Design of Machine Components" Bhonsle, S.R., and Weinmann, K.J., Prentice Hall.*
8. *"Bond Graph in Modeling, Simulation and Fault Identification", Mukherjee, A., Karmaker, R. and Samantaray, A.K., I & K International.*
9. *"Systems Modelling & Analysis", I.J. Nagarath & M. Gopal, Tata McGraw Hill.*

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 thermal analysis using ANSYS.
9. Transient thermal analysis using ANSYS.
10. Transient analysis of vibrating system ANSYS.

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11. Introduction to durability analysis of Mechanical component using ANSYS.
12. Introduction to rigid body dynamic analysis using ANSYS.
13. Introduction to Topology optimization and Structure/Weight Optimization.
14. 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	TEACHER ASSESSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT*				
BTME607	DS	ROBOTRONICS LAB	0	0	0	0	50	0	0	4	2

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 make the students to learn about the mechanical engineering aspects of Robots and their application.

Course Outcomes (COs):

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

1. Basics of robots
2. Industrial robots: Structure and applications.
3. Robot kinematics, coordinate frames
4. Control systems for motion control and control of interaction forces.
5. Robot Dynamics and Robot Vision.
6. Industrial application of robots.

Syllabus

Unit -I

Introduction to Robotics Evolution of Robots and Robotics, Laws of Robotics, What is and what is not a Robot, Robot Anatomy, Human Arm Characteristics, The Future Prospects, Notations.

Unit -II

Coordinate Frames, Mapping and Transforms Coordinate Frames, Description of Objects in Space, Transformation of Vectors, Inverting a Homogeneous Transform, Fundamental Rotation Matrices.

Unit -III

Symbolic Modeling of Robots, Direct Kinematic Model Mechanical Structure and Notations, Description of Links and Joints, Kinematic Modeling of the Manipulator, Kinematic Relationship between Adjacent Links.

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Unit -IV

Robotic Sensors and Vision the Meaning of Sensing, Sensors in Robotics, Kinds of Sensors used in Robotics,Process of Imaging, Architecture of Robotic Vision Systems, Image Acquisition, Description of Other components of Vision System, Image Representation, Image Processing.

Unit - V

Robot Applications- Industrial Applications, Material Handling, Processing Applications, Assembly Applications, Inspection Application, Principles for Robot Application and Application Planning, Justification of Robots, Robot Safety, Non-Industrial Applications, Robotic application for sustainable Development.

Reference Books:

1. *"Robotics & Control", by R.K. Mittal & I.J. Nagrath – TMH Publications*
2. *"Robotics for engineers",by Yoram Korean- McGrew Hill Co.*
3. *"Industrial Robotics Technology programming and Applications", by M.P.Groover, M.Weiss, R.N.Nagel, N.G.Odrey*
4. *"Robotics Control Sensing, Vision and Intelligence", by K.S.Fu, R.C.Gonzalex, C.S.G.Lee- McGrew hill Book co.*
5. *"Kinematics and Synthesis of linkages",by Hartenberg and Denavit – McGrew Hill Book Co.*
6. *"Kinematics and Linkage Design", by A.S. Hall – Prentice Hall*
7. *"Kinematics and Dynamics of Machinery", by J.Hirchhorn – McGrew HillBook Company.*

List of Experiments:

1. To study the parts of robot and classification of robots.
2. To perform the Robot programming exercise for Pick and Place operation.
3. Design modeling and analysis of two different types of grippers
4. To study the Robot path planning using Robotic simulation software.
5. Demonstration of robot with 2 DOF, 3 DOF, 4 DOFetc.
6. Two case studies of applications in industry.

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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*				
BTEE608	ODS	AUTOMOTIVE ELECTRICAL AND ELECTRONICS LAB	0	0	0	0	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):

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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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT*				
ML601	ODS	TECHNICAL COMMUNICATION AND SOFT SKILLS	0	0	10	0	0	2	0	0	2

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 give students introduction of Information design and development (B) To provide students understanding of Technical writing (C) To introduce students to carrier planning (D) To make student aware of Ethics in Industries.

Course Outcomes (COs)

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

1. Design different technical documents.
2. To set goals for carrier planning.
3. To correlate Ethics with Industrial environment.

Syllabus

Unit - I

Information Design and Development: Different kinds of technical documents, Information development life cycle, Organization structures, factors affecting information and document design, Strategies for organization, Information design and writing for print and for online media.

Unit - II

Technical Writing, Grammar and Editing: Technical writing process, forms of discourse, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style, Introduction to advanced technical communication, Usability, Hunan factors, Managing technical communication projects, time estimation, Single sourcing, Localization.

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Unit - III

Self-Development and Assessment: Self-assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, Self-esteem.

Unit - IV

Communication and Technical Writing: Public speaking, Group discussion, Oral; presentation, Interviews, Graphic presentation, Presentation aids, Personality Development. Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.

Unit-V

Ethics: Business ethics, Etiquettes in social and office settings, Email etiquettes, Telephone Etiquettes, Engineering ethics, Managing time, Role and responsibility of engineer, Work culture in jobs, Personal memory, Rapid reading, Taking notes, Complex problem solving, Creativity.

Reference Books:

1. "Guide to writing as an Engineer", by David F. Beer and David McCurry, John Willey. New York, 2004
2. "Pocket Style Manual", by Diane Hacker, Bedford Publication, New York, 2003. (ISBN0312406843)
3. "You Can Win", by Shiv Khera, Macmillan Books, New York, 2003.
4. "Technical Communications", by Raman Sharma, Oxford Publication, London, 2004
5. "Business Correspondence and Report Writing, Sharma", by R. and Mohan, K. TMH New Delhi 2002

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