



C. U. SHAH UNIVERSITY
Wadhwan City

FACULTY OF: - Technology and Engineering
DEPARTMENT OF: - Automobile Engineering
SEMESTER: - VI
CODE: - 4TE06TQM1
NAME: – Total Quality Management

Teaching and Evaluation Scheme:-

Subject Code	Name of the Subject	Teaching Scheme (Hours)				Credits	Evaluation Scheme								
		Th	Tu	Pr	Total		Theory				Practical (Marks)				Total
							Sessional Exam		University Exam		Internal		University		
							Marks	Hrs	Marks	Hrs	Pr/Viva	TW	Pr		
4TE06TQM1	Total Quality Management	3	0	0	3	3	30	1.5	70	3	---	---	---	100	

Objectives:

- To understand the philosophy and core values of Total Quality Management (TQM).
- To apply and evaluate best practices for the attainment of total quality.
- To determine the voice of the customer and the impact of quality on economic performance and long-term business success of an organization.

Prerequisite:

- Fundamentals of Industrial Engineering & Management.

Course Outline:

Sr. No.	Course Content	Hours
1	Introduction: Introduction - Basic concepts of TQM, Need and evolution of Quality Management, Dimensions of manufacturing and service quality, TQM Framework, Contributions of Deming, Juran and Crosby, Barriers to TQM, Quality cost estimation and reduction, Quality policy and objectives.	06
2	TQM Principles: Leadership – Strategic quality planning, Quality statements, Customer focus, Customer orientation, Customer satisfaction, Customer complaints, Customer retention, Employee involvement, Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal, Continuous process improvement, PDSA cycle, 5s, Kaizen, Supplier partnership, Partnering, Supplier selection, Supplier Rating.	08
3	TQM Tools & Techniques: The seven traditional tools of quality. New management tools. Six-sigma - Concepts, methodology, applications to manufacturing & service sector, Bench marking and POKA YOKE. FMEA - Stages, Types. Quality circles. Quality Function Deployment (QFD). Taguchi quality loss function. TPM - Concepts, improvement needs. Cost of Quality. Performance measures. Design, process and documentation. Introduction to programming in MATLAB. Case studies of TQM tools & techniques.	10

4	Statistical Process Control: Statistical Concept of Variation, frequency distribution, continuous and discrete, probability distributions viz. Normal, Exponential and weibull distribution, pattern of variation, significance tests, Analysis of variance, statistical aids in limits and tolerances. Construction of control charts for variables and attributes. Process capability – meaning, significance and measurement – Six sigma concepts of process capability. Reliability concepts – definitions, reliability in series and parallel, Product life characteristics curve, Terotechnology. Business process Improvement (BPI) – principles, applications, reengineering process, benefits and limitations.	11
5	Regression Analysis: Linear Regression Analysis, Non Linear Regression Analysis, Correlation Coefficient.	04
6	Quality Systems Organizing and Implementation: Introduction. Need for ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing. TQM culture, Leadership – quality council, employee involvement, motivation, empowerment, recognition and reward. TQM framework, benefits, awareness and obstacles. QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors.	06

Learning Outcomes:

- Understanding on quality management philosophies and frameworks
- In-depth knowledge on various tools and techniques of quality management
- Knowledge of quality tools and techniques in both manufacturing and service industry
- Improvement in analytical skills for investigating and analyzing quality management issues in the industry and to suggest implement able solutions.

Books Recommended:

1. Total Quality Management by **Suganthi, L and Anand Samuel** Prentice Hall (India) Pvt. Ltd.,2006.
2. MATLAB and its applications in Engineering by **Rajkumar Bansal, Ashok kumar Goyal, Manoj kumar Sharma**, Pierson Publishers.

Reference Books:-

1. Total Quality Management by **Dale H. Besterfiled, et at.** Pearson Education Asia, 3rd Edition, Indian Reprint (2006).
2. Total Quality Management by **Dr. S. Kuma**, University Science Press.
3. The Management and Control of Quality by **James R. Evans and William M. Lindsay**, 6th Edition, South-Western (Thomson Learning), 2005.
4. MATLAB programming for Engineers by **Stephen Chapman**, Thomson Publishers.
5. Mastering MATLAB by **Hunselman Duane**, Pearson Education, New Delhi, 2011
6. Reliability Engineering by **L. S. Srinath**, Affiliated East-west Press Pvt Ltd.



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FACULTY OF: - Technology and Engineering
DEPARTMENT OF: - Automobile Engineering
SEMESTER: -VI
CODE: - 4TE06ACB1
NAME: – Automobile Chassis & Body Engineering

Teaching and Evaluation Scheme:-

Subject Code	Name of the Subject	Teaching Scheme (Hours)				Credits	Evaluation Scheme								
		Th	Tu	Pr	Total		Theory				Practical (Marks)				Total
							Sessional Exam		University Exam		Internal		University		
							Marks	Hrs	Marks	Hrs	Pr/Viva	TW	Pr		
4TE06ACB1	Automobile Chassis & Body Engineering	3	0	2	5	4	30	1.5	70	3	---	20	30	150	

Objectives:

- To impart knowledge in the construction of vehicles and learn different vehicle structural design and their requirements.

Prerequisite:

- Basic Knowledge of Automobile Engines and Automobile Systems.

Course Outline:

Sr. No.	Course Content	Hours
1	Vehicle aerodynamics: Vehicle drag and types – various types of forces and moments – effects of forces and moments, various body optimization techniques for minimum drag.	05
2	Car body: Types, Regulations, Drivers seat design & dimensions parameters, drivers visibility, methods for improving visibility and space in cars, design for safety, safety requirements for car (with reference to Vehicle Body Engineering), car body construction. Crash Test and Roll over test regulations. Heating and ventilation systems. Dash boards, instrument panel and passenger compartment lighting, Audio – visual systems.	10
3	Bus body: Types: Mini bus, single and double decker, two level, split level and articulated bus. Bus body layout – Floor height - Engine location - Entrance and exit location - Seating dimensions. Constructional details: Frame construction, Double skin construction -Types of metal section used - Regulations -Conventional and integral type construction.	07
4	Commercial vehicle details : Classification of commercial vehicle bodies. Construction of Tanker body and Tipper body. Dimensions of drivers, seat in relation to controls. Driver’s cab design. Compactness of Driver’s cab. Segmental construction of driver’s cab.	09
5	Body Loads: Idealized structure, structural surface, shear panel method, symmetric and asymmetric vertical loads in a car, longitudinal load, different loading situations, and chassis frame design. Construction of Doors, door apertures, windows. Spare wheel carrier construction and design for different types of vehicle and weight distribution criteria in relation to Spare wheel location. Sources of body noises testing and methods of elimination. Water leakage test.	08

6	Body materials, trim and mechanisms: Aluminum alloy sheet, extrusion and casting, stainless steels, alloy steels, Metal Matrix Composites. Structural timbers -properties. Designing in GRP and high strength composites, Thermo plastics, Load bearing plastics, semi-rigid PUR foams and sandwich panel construction. Corrosion, Anticorrosion methods. Selections of paint and painting process, Body trim items.	06
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Learning Outcomes:

Students will be able to...

- Design and implement knowledge practically of Vehicle structures.
- Develop efficient and safe designs with consideration of all constraints.

Books Recommended:

3. Automotive Chassis & Body by **P. L. Kohli**, Papyrus Publishing House, New Delhi.
4. Automotive Chassis by **Crouse W.H. & Anglin D. L.**, McGraw-Hill Int. Book Co.
5. Vehicle Body Engineering by **J. Powloski**, Business Books Ltd., London.

Reference Books:-

1. Body Engineering by **Sydney F. Page**, Chapman & Hill Ltd., London.
2. Fundamentals of Vehicle Body work by **J. Fairbrother**, Hutchinson, London.
3. Automotive Chassis by **P.M. Heldt**, Chilton Co. NK
4. Vehicle Body Layout & Analysis by **John Fenton**, Hutchinson, London.
5. Body Construction and Design, (Vol. 6) by **J.G. Giles**, Lefe Books/Butterworth & Co. London



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FACULTY OF: - Technology and Engineering
DEPARTMENT OF: - Automobile Engineering
SEMESTER: -VI
CODE: - 4TE06ACD1
NAME: – Automobile Component Design.

Teaching and Evaluation Scheme:-

Subject Code	Name of the Subject	Teaching Scheme (Hours)				Credits	Evaluation Scheme							
		Th	Tu	Pr	Total		Theory				Practical (Marks)			Total
							Sessional Exam		University Exam		Internal		University	
							Marks	Hrs	Marks	Hrs	Pr/Viva	TW	Pr	
4TE06ACD1	Automobile Component Design	4	0	2	6	5	30	1.5	70	3	---	20	30	150

Objectives:

- This subject deals with fundamental principle of machine design applied to automobile components.
- Develop analytical abilities to give solutions to Automotive design problems
- To develop analytical abilities for providing solutions to engineering design problems.
- Use design data book to standardize component dimensions.
- To learn to use standard practices and standard data.
- To impart knowledge in the construction of vehicles and learn different vehicle structural design and their requirements.

Prerequisite:

- Basic and analytical knowledge of Strength of materials, Machine Design and Industrial Drafting and Automobile system design.

Course Outline:

Sr. No.	Course Content	Hours
1	<p>Design of Gears: Design consideration of gears, material selection, types of gear failures</p> <p>Spur Gears and Parallel Axis Helical Gears: Speed ratios and number of teeth, Force analysis, Tooth stresses, Dynamic effects, Fatigue strength, Factor of safety, Design of straight tooth spur & helical gears based on strength and wear considerations – Pressure angle in the normal and transverse plane, Equivalent number of teeth, forces for helical gears.</p> <p>Bevel and Worm Gears: Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth, Estimating the dimensions of pair of straight bevel gears, Worm Gear: Merits and demerits, terminology, Thermal capacity, forces and stresses, efficiency, estimating the size of the worm gear pair, Epicyclic Gears for Auto Transmission.</p>	20
2	<p>Design of Gear Boxes: Introduction, Basic consideration of design of drives, determination of variable speed range, Geometric progression - Standard step ratio – Structural formula and Structural diagram, Ray diagram, kinematics layout, Design of sliding mesh gear box, Design of multi speed gear box.</p>	08

3	<p>Design of Sliding Contact and Rolling Contact Bearings:</p> <p>Sliding Contact Bearing: Bearing and Lubrication, types of lubrication and lubricants, viscosity, Design of hydrodynamic journal bearings. Classification, material selection, Sommerfeld number and use of charts for the estimation of minimum film thickness, temperature rise, L/D Ratio, Clearance ratio, flow quantity etc., Hydrostatic bearing.</p> <p>Rolling Contact Bearings: Rolling contact bearings. Classification and selection, stribeck's equation, static and dynamic load capacity, equivalent dynamic load, Bearing under variable loading, Bearing life, factors affecting bearing life.</p>	12
4	<p>Design of I.C. Engine components:</p> <p>Design of cylinder and piston: Choice of material for cylinder and piston, piston friction, design of cylinder, piston, piston pin, piston rings, piston failures.</p> <p>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.</p> <p>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.</p> <p>Design of Combustion chamber.</p>	20

Learning Outcomes:

- The students will learn to make proper assumptions, perform correct analysis while designing specific automotive components.
- Design automotive component to meet desired needs.
- Apply the fundamental knowledge of Applied Mechanics, Strength of Materials, Engineering Materials and Theory of Machine for actual design problems.
- Able to use design data books and different codes of design.

Books Recommended:

1. Machine Design by **Khurmi & Gupta**. S. Chand publication.
2. Machine Design by **Pandya and shah**, Charotar Publishing House.
3. Design of Machine Elements by **V. B. Bhandari**, Tata McGraw Hill Publishing Co.1994
4. Design of Machine Elements by **C. S. Sharma & Kamlesh Purohit**, Prentice Hall of India Pvt. Ltd.
5. Machine Design by **P. C. Sharma and D. K. Aggarwal**, S.K. Kataria & Sons 2009

Reference Books:-

1. P.S.G Design data book (PSG college of engg. & Tech.).DPV Printers,Coimbatore,2000
2. Machine Design by **R.C.Patel and A.D.Pandya** Vol-1 and Vol-2,C.Jamnadas & Co.1992
3. Machine Design – An Integrated Approach by **Robert L Norton**, Pearson Education.2005
4. Machine elements : life and design, by **Boris M. Klebanov, David M. Barlam**, Frederic E. Nystrom.
5. Mechanical Engineering Design, by **Joseph Edward Shigley and Charles R. Mischke**, McGraw Hill International Edition,
6. Mechanical System Design, by **Farazdak haideri**, Nirali Prakashan.
7. Machine Design, by **R. K. Jain**, Khanna publications.
8. Transmission System Design, by **R. B. Patil**, TechMax Pub., Pune.
9. I. C. Engine, by **Maleev and Litchy**, McGraw Hill Book
10. I. C. Engines, by **C. Fayette Taylor & Edward S. Taylor**, International Textbook.com



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FACULTY OF: - Technology and Engineering
DEPARTMENT OF: - Automobile Engineering
SEMESTER: -VI
CODE: - 4TE06APC1
NAME: – Automobile Pollution and Control

Teaching and Evaluation Scheme:-

Subject Code	Name of the Subject	Teaching Scheme (Hours)				Credits	Evaluation Scheme								
		Th	Tu	Pr	Total		Theory				Practical (Marks)				Total
							Sessional Exam		University Exam		Internal		University		
							Marks	Hrs	Marks	Hrs	Pr/Viva	TW	Pr		
4TE06APC1	Automobile Pollution and Control	3	0	2	5	4	30	1.5	70	3	---	20	30	150	

Objectives:

- To impart knowledge to students in various impact of automobile emission on the environment and Human, various control technique of Pollutions.

Prerequisite:

- Fundamental of Automobile Engines.

Course Outline:

Sr. No.	Course Content	Hours
1	Introduction: Vehicle population assessment in metropolitan cities and contribution to pollution, effects on human health and environment, global warming, types of emission, transient operational effects on pollution, noise vibration and hardness.	08
2	Pollutant Formation in SI Engines: Pollutant formation in SI Engines, mechanism of HC and CO formation in four stroke and two stroke SI engines, NOx formation in SI engines, effects of design and operating variables on emission formation, control of evaporative emission. Two stroke engine pollution.	06
3	Pollutant Formation in CI Engines: Pollutant formation in CI engines, smoke and particulate emissions in CI engines, effects of design and operating variables on CI engine emissions. NOx formation and control. Noise pollution from automobiles, measurement and standards.	06
4	Control Technique for SI and CI Engines: Design changes, optimization of operating factors, exhaust gas recirculation, fumigation, air injector PCV system-Exhaust treatment in SI engines-Thermal reactors-Catalytic converters, Catalysts, Use of unleaded petrol.	04
5	Emission Measurement Techniques: Gas Chromatograph, smoke meters, Orsat Apparatus, NDIR, FID.	04
6	Emission Standards And Test Procedure: Emission standards, driving cycles – USA, Japan, Euro and India. Test procedures – ECE, FTP Tests. SHED Test – chassis dynamometers, dilution tunnels.	04

Learning Outcomes:

- Student will be able to understand about pollution formation in engine, treatment and control technique and pollution measurement.
- The subject helps the students to understand the latest developments in the field of pollution control.

Books Recommended:

1. Internal combustion engines, by **Mathur & Sharma** , Dhanpatrai & sons, New Delhi.
2. Engine Emission, by **B. P. Pundir**, Alpha Science Int. LTD.
3. Internal combustion engines, by **V. Ganeshan** ,Tata Mc Grawhill pub.co. ltd., New Delhi.

Reference Books:-

1. Vehicle Emission, by SAE Transactions 1982 (3 volumes).
2. Internal Combustion Engines, by **Taylor. C.F**, MIT Press.
3. Emissions from two stroke engines, by **Marco Nute**, SAE Publication, 1998



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FACULTY OF: - Technology and Engineering
DEPARTMENT OF: - Automobile Engineering
SEMESTER: -VI
CODE: - 4TE06ACA1
NAME: – Automotive CAD

Teaching and Evaluation Scheme:-

Subject Code	Name of the Subject	Teaching Scheme (Hours)				Credits	Evaluation Scheme							
		Th	Tu	Pr	Total		Theory				Practical (Marks)			Total
							Sessional Exam		University Exam		Internal		University	
							Marks	Hrs	Marks	Hrs	Pr/Viva	TW	Pr	
4TE06ACA1	Automotive CAD	4	0	2	6	5	30	1.5	70	3	---	20	30	150

Objectives: The student will have good exposure to computer aided design to familiarize with

- Concepts of modeling in 2D and 3D.
- Concepts of computer graphics.
- CAD Packages and its features.
- Theory of analysis and its implementation in CAD.

Prerequisite:

- Basics of drawing and mechanical design, C programming, Computer soft skill, Basic understanding of Matrices.

Course Outline:

Sr. No.	Course Content	Hours
1	Fundamentals of CAD: Introduction, Reasons for implementing a CAD system, Computer Aided Process application, conventional design vs CAD. Benefits, Hardware, CAD software's, Elements of Programming, CAD programming. Technical specification of CAD workstation, computer software-operating system	05
2	Computer Graphics: Scan conversions, DDA and Bresnham's algorithm for generation of various figure, 2D and 3D transformations: Scaling, Translation, Rotation, Mirroring, Clipping, Homogeneous matrix.	08
3	Geometrical Modeling : Types & mathematical representation of curves, wire frame models, entities, representations, parametric representations. Review of vector algebra, lines, circle, ellipse, parabolas, Parametric representation of synthetic curves, cubic curves, b - spline, Bezier spline, sweep curves, Surfaces & solids – model, entities, representations, fundamentals of surface and solid modeling, B-rep, constructive solid geometry (CSG), analytical modeling, sweep. Solid manipulation, visual realism. Computer aided design of Mechanical Elements & Mechanical Assembly with animation. Capabilities of various commercially available software like Ansys, Fluent, CFD, Hyper works, Solid works, ProE, CATIA in the area of CAD.	15

4	Introduction to FEM: basic concepts, historical back ground, application of FEM, general description, comparison of FEM with other methods, Variational approach, Galerkin's Methods. Co-ordinates, basic element shapes, interpolation function. Virtual energy principle, Rayleigh-Ritz method, properties of stiffness matrix, treatment of boundary conditions, solution of system of equations, shape functions and characteristics, Basic equations of elasticity, strain displacement relations	08
5	1-D & 2-D Problem: 1-D structural problems, axial bar element, stiffness matrix, load vector, temperature effects, Quadratic shape function. Analysis of Trusses, Plane Truss and Space Truss elements. 1 - D Heat conduction, 1- D fin element, 2 - D heat conduction problems.	10
6	Design of Vehicle components: Application for design of vehicle components and mathematical modeling with program in C++ on design problems like shaft, propeller shaft, axles, gear box, gears, spring and suspension system, brake design, clutch design , body design.	07
7	Optimization: Introduction, design synthesis, Engineering vs Optimum Design, Objectives of Optimization, Classification of Optimization problems and their procedure, techniques of optimization, Optimized design of machine components, Optimization Software.	07

Learning Outcomes:

- Interpret complex engineering drawings including geometric dimensioning and tolerance.
- Perform competently in solving technical manufacturing and engineering mathematics problems.
- Exhibit competency in two-dimensional, three-dimensional and solid-modeling skills as applied to complex computer-aided design technology.
- Demonstrate an understanding of the role and function of computers and effectively use the computer to solve complex technical problems.

Books Recommended:

1. CAD/CAM Theory & Practice by **Ibrahim Zeid**, Tata Mc Graw Hill
2. A Textbook of Finite Element Analysis, **P. Seshu**, PHI
3. Optimization Methods, by **S.S. Rao**, New Age International Publications

Reference Books:-

1. CAD/CAM and Automation by **Farazdak Haideri**, Nirali Prakashan
2. CAD / CAM / CIM by **Radhakrishnan and Subramanian**, New Age
3. Introduction to finite elements in engineering by **Tirupathi K. Chandrupatla and Ashok D. Belegundu**, Prentice Hall
4. Finite element methods by **Lagon**, Thomson Asia Pvt. Ltd.
5. Principles of Computer Aided Design and Manufacturing by **Farid Amirouche**, Pearson
6. Computer Aided Design by **Krishnamurthy**, Narsova Publications.
7. Finite element technique by **Belagondur**, PHI



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FACULTY OF: - Technology and Engineering
DEPARTMENT OF: - Automobile Engineering
SEMESTER: -VI
CODE: - 4TE06MSI1
NAME: – Modeling and Simulation of I.C. Engines

Teaching and Evaluation Scheme:-

Subject Code	Name of the Subject	Teaching Scheme (Hours)				Credits	Evaluation Scheme							
		Th	Tu	Pr	Total		Theory				Practical (Marks)			Total
							Sessional Exam		University Exam		Internal		University	
							Marks	Hrs	Marks	Hrs	Pr/Viva	TW	Pr	
4TE06MSI1	Modeling and Simulation of I.C. Engines	3	0	0	3	3	30	1.5	70	3	---	---	---	100

Objectives:

- To learn the simulation techniques to estimate the performance and emission characteristics of IC engines.

Prerequisite:

- Basics of I.C. Engine & Computer soft skill

Course Outline:

Sr. No.	Course Content	Hours
1	Introduction: First law and second law analysis, governing equation, conservation of mass, momentum and energy.	04
2	Combustion in SI engines : Combustion in premixed flames - stages of combustion, flame propagation, rate of pressure rise, cycle-to-cycle variation, abnormal combustion - theories, effect of engine operating variables on combustion.	07
3	Combustion in CI engines: Combustion in diffusion flames - droplet and spray combustion theory, stages of combustion, delay period, peak pressure, heat release, gas temperature, diesel knock.	07
4	Modeling of IC engines: Heat of reaction - Hrp & Urp calculations, adiabatic, constant volume combustion, constant pressure combustion, temperature drop due to fuel vaporization, adiabatic flame temperature, mean effective pressure, torque and thermal efficiency at full throttle, part throttle and supercharged conditions. Spray models, flow models and combustion models	10
5	Simulation of IC engines: SI & CI engine simulation – air standard cycle, fuel-air cycle, progressive combustion cycle and actual cycle simulation – part throttle, full throttle and supercharged conditions.	09
6	Simulation of new engine concepts: Dual fuel engine, low heat rejection engine, lean burn engine, variable compression ratio engine, homogeneously charged compression ignition engine, controlled auto ignition engine.	08

Learning Outcomes:

- At the end of this course, the student will be able to understand the various simulation techniques for SI and CI Engines.

Books Recommended:

1. Computer Simulation of spark ignition engine process by **V. Ganesan** , Universities Press (I) Ltd, Hyderabad, 2001
2. Internal Combustion Engine Fundamentals by **Heywood J B**, McGraw Hill Book Co., USA –2001.
3. Computer Simulation of compression ignition engine process by **V. Ganesan**, University Press (I) Ltd, Hyderabad, 1996
4. Modeling of Internal Combustion Engines Processes by **Ramoss A. L.**, McGraw Hill Publishing Co., 1992.
5. Thermodynamic analysis of combustion engines by **Ashley Campbel**, John Wiley & Sons, New York, 1986.
6. Internal Combustion Engines by **Benson R. S. and Whitehouse N. D.**, Paragon Press, oxford, 1979.



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FACULTY OF: - Technology and Engineering
DEPARTMENT OF: - Automobile Engineering
SEMESTER: -VI
CODE: - 4TE06VNH1
NAME: – Vibration Noise & Harshness control

Teaching and Evaluation Scheme:-

Subject Code	Name of the Subject	Teaching Scheme (Hours)				Credits	Evaluation Scheme								
		Th	Tu	Pr	Total		Theory				Practical (Marks)				Total
							Sessional Exam		University Exam		Internal		University		
							Marks	Hrs	Marks	Hrs	Pr/Viva	TW	Pr		
4TE06VNH1	Vibration Noise & Harshness control	3	0	0	3	3	30	1.5	70	3	---	---	---	100	

Objectives:

- Introduce applications of noise and vibration control to students.
- Introduce students how to mathematical modeling the vibration system.
- Enable students to understand noise and its measurements.

Prerequisite:

- Basic Knowledge of mathematics and Vibration.

Course Outline:

Sr. No.	Course Content	Hours
1	Multi Degree Freedom System: Free Vibration equation of motion. Influence Coefficient (i) Stiffness Coeff. (ii) Flexibility Coeff. Generalized co-ordinates, and Coordinate couplings. Langranges Equations Matrix Method Eigen Values Eigen Vector problems. Modal Analysis. Forced Vibrations of undamped system and modal analysis. Forced Vibrations of damped system and modal analysis.	07
2	Multi Degree System Numerical Methods: (i)Rayleigh`s Method, (ii)Rayleigh-Ritz Method (iii) Holzer`s Method (iv)Methods of Matrix iterations (v) Transfer Matrix Method, Impulse response and frequency response functions.	05
3	Continuous System: Vibrations of String, Bars, Shafts and beams, free and forced vibration of continuous systems.	03
4	Transient vibrations: Response of a single degree of freedom system to step and any arbitrary excitation, convolution (Duhamel`s) integral, impulse response functions.	04
5	Vibration Control: Balancing of rotating machine, In-situ balancing of rotors, control of natural frequency introduction of damping, vibration isolation & vibration absorbers.	04
6	Vibration Measurement: FFT analyzer, vibration exciters, signal analysis. Time domain & Frequency domain analysis of signals. Experimental modal analysis, Machine Conditioning and Monitoring, fault diagnosis.	05

7	Random Vibrations: Expected values auto and cross correlation function, Spectral density, response of linear systems, analysis of narrow band systems.	04
8	Non Linear Vibrations: Systems with non-linear elastic properties, free vibrations of system with non-linear elasticity and damping, phase-plane technique, Duffing's equation, jump phenomenon, Limit cycle, perturbation method.	04
9	Noise and Its Measurement: Sound waves, governing equation its propagation, Fundamentals of Noise , Decibel, Sound Pressure level, Sound Intensity, Sound fields, reflection, absorption and transmission .Noise measurement , Sound meter , Allowed exposure levels and time limit by B.I.S., Octave Band analysis of sound, Fundamentals of Noise control, source control, path control ,enclosures, noise absorbers, noise control at receiver.	06
10	Harshness and Its Measurement: Harshness, sources, its effects, measurement and control.	03

Learning Outcomes:

Students will be able to...

1. Describe the consequences to health and wellbeing of excessive exposure to noise, and vibration.
2. Understand the measurement of noise, and vibration in relation to current standards
3. Provide a basic understanding of fundamental concepts in Engineering Noise Control.
4. Apply these concepts to the solution of practical problems

Books Recommended:

1. Mechanical Vibrations by **S S Rao**, Addison-Wesley Publishing Co
2. Mechanical Vibrations by **G K Groover**, published by Nemchand & Brothers, Roorkee.
3. Mechanical Vibrations by **Tse, Morse & Hinkle**, Prentice Hall of India Ltd., New Delhi, 1987.

Reference Books:-

1. Theory of Vibrations with Applications by **W T Thomson**, CBS Publishers Delhi
2. Fundamentals of Vibration by **Leonard Meirovitch** , McGraw Hill International Edison.
3. Principles of Vibration Control by **Asok Kumar Mallik**, Affiliated East- West Press.
4. Mechanical Vibrations by **A H Church** ,John Wiley & Sons Inc
5. Mechanical Vibrations by **J P Den Hartog** ,McGraw Hill.
6. Mechanical Vibration Analysis by **Srinivasan** ,McGraw Hill.
7. Vibration and Noise for Engineers by **Kewal Pujara** , Dhanpat Rai & co.



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FACULTY OF: - Technology and Engineering
DEPARTMENT OF: - Automobile Engineering
SEMESTER: -VI
CODE: - 4TE06HPS1
NAME: – Hydraulic & Pneumatic Systems

Teaching and Evaluation Scheme:-

Subject Code	Name of the Subject	Teaching Scheme (Hours)				Credits	Evaluation Scheme								
		Th	Tu	Pr	Total		Theory				Practical (Marks)				Total
							Sessional Exam		University Exam		Internal		University		
							Marks	Hrs	Marks	Hrs	Pr/Viva	TW	Pr		
4TE06HPS1	Hydraulic & Pneumatic Systems	3	0	0	3	3	30	1.5	70	3	---	---	---	100	

Objectives:

- The course aims to make student understand the structure and the properties of the fluid.
- To understand the energy exchange process in fluid mechanics handling incompressible fluids.

Prerequisite:

- Basic Knowledge of structure and the properties of the fluid.

Course Outline:

Sr. No.	Course Content	Hours
1	Introduction to Fluid Power: Classification, application of various fluids in engineering, various Symbols used in hydraulic and pneumatic (ISO/JIC), transmission of power at static and dynamic states.	04
2	Basic Concept & Properties: Fluid - definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillary and surface tension - Fluid statics: concept of fluid static pressure, absolute and gauge pressure measurements by manometers and pressure gauges.	04
3	Hydraulic system elements: Control of fluid power elements: Requirement of pressure control, direction control, flow control valves. Principles of pressure control valves, direction control valves, and pilot operated relief valve, pressure reducing valve, quick exhaust valve, sequence valves. Types of direction control valves – two way two position, four way two position, four way three position, open center, close center, tandem center, manual operated, solenoid, pilot operated direction control valves, check valves. Flow control valves: principle and their types, meter-in and meter-out circuit and flow through circuit. Actuators: linear and rotary, hydraulic motors, types of hydraulic cylinders and their mountings. Calculation of piston velocity, thrust under static and dynamic operation & Application, consideration of friction and inertia loads.	08

4	Pneumatics: Principle of Pneumatics: (i) Laws of compression, types of compressors, selection of compressors. (ii) Comparison of Pneumatics with Hydraulic power transmissions. (iii) Types of filters, regulators, lubricators, mufflers, dryers. (iv) Pressure regulators – Fine & Coarse, Electro-pneumatic Pressure Regulators (I/P & E/P) with its applications (v) Direction control valves, two way, three way, four way valves. Solenoid operated valves, push button, lever control valves. (vi) Speed regulating - Methods used in Pneumatics. (vii) Pneumatic actuators-rotary, reciprocating – Power Clamps & its applications in BIW.(viii) Air motors- radial piston, vane, axial piston (ix) Basic pneumatic circuit, selection of components(x) Application of pneumatics in low cost Automation and in industrial automation Introduction to vacuum generators, vacuum regulators, vacuum filters & types of vacuum cups, vacuum measurement, Vacuum pumps, types, introduction to vacuum sensors and valves. Industrial application of vacuum in material handling & leak testing.	08
5	Hydraulic/Pneumatic Circuit: Basic pneumatic and Hydraulic circuit, impulse operation, speed control, pneumatic motor circuit, sequencing of motion, time delay circuits and their applications.	06
6	Typical Automotive Applications: Hydraulic tipping mechanism, power steering, fork lift hydraulic gear, hydro-pneumatic suspension (Air suspension), Clutch actuating System, Brakes – Hydraulic AND Pneumatic.	08
7	Maintenance and trouble shooting of hydraulic & pneumatic circuits.	03
8	Introduction to fluidics: study of simple logic gates, turbulence, amplifiers, pneumatic sensors and applications.	04

Learning Outcomes:

- At the end of the semester students will be understand appreciate the complexities involved in solving the fluid flow problems.
- In-depth knowledge on various tools and techniques of Hydraulic and pneumatic problem

Books Recommended:

1. Hydraulic & pneumatics by **Andrew Parr**, Jaico Publishing House.
2. Basic fluid power by **D.A. Pease**-PHI
3. Industrial Hydraulic & pneumatics by **J.J. Pippenger** , McGraw Hill
4. Fluid Power with applications by **A. Esposito**, PHI
5. Oil Hydraulics by **B Lal**, Intl- Literature

Reference Books:-

1. Fluid Mechanics by **Streeter, V.L. and Wylie**, E.B, McGraw-Hill, 1983
2. Hydraulic Machines, Theory and Design by **Vasaadani, V.P.**, Khanna Publishers, 1992



C. U. SHAH UNIVERSITY
Wadhwan City

FACULTY OF: - Technology and Engineering
DEPARTMENT OF: - Automobile Engineering
SEMESTER: - VI
CODE: - 4TE06TML1
NAME: – Transport Management and Laws

Teaching and Evaluation Scheme:-

Subject Code	Name of the Subject	Teaching Scheme (Hours)				Credits	Evaluation Scheme							
		Th	Tu	Pr	Total		Theory				Practical (Marks)			Total
							Sessional Exam		University Exam		Internal		University	
							Marks	Hrs	Marks	Hrs	Pr/Viva	TW	Pr	
4TE06TML1	Transport Management and Laws	3	0	0	3	3	30	1.5	70	3	---	---	---	100

Objectives:

- The course aims to make student able to manage a transport fleet and their related activities for minimizing operational cost.
- To get familiar with provisions of motor vehicle act and vehicle insurance.

Prerequisite:

- Basic Knowledge of Automobile Systems.

Course Outline:

Sr. No.	Course Content	Hours
1	Introduction: Necessity for making acts and rules on motor vehicles; Procedure for enactment and implementation of these acts by central and state Govts; Formats of the acts; rules and titles; Definitions – articulated vehicle; axle weight; certificate of registration; driver; conductor; license; contract carriage; stage carriage; dealer; educational institution bus; goods; goods carriage; gross vehicle weight; heavy goods vehicle; invalid carriage; learners license; HMV; LMV; motor cabs etc.	04
2	Motor Vehicle Act: Licensing of drivers and conductors, registration of vehicles, control of transport, RTO and other regulations, offences, penalties and procedures, types of form and procedures, licensing of taxies and buses, rules and regulations, testing and passing of vehicles. Taxation: Structure, method of laying taxation, goods vehicle taxation, passenger vehicle taxation, mode of payment, tax exemption, one / life time taxation. Service Life of vehicles. Toll tax reasons & operational management. Build Operate Transfer arrangement.	10
3	Insurance: Insurance types & significance- Comprehensive- Third party insurance Furnishing of particulars of vehicles involved in accident- MACT (Motor Accident Claims Tribunal) - Solatium Fund- Hit & Run case- Duty of driver in case of accident- Surveyor & Loss Assessor, Surveyor's report.	07

4	Passenger Transport Operation: Structure of passenger transport organizations, Typical depot layouts, Requirements and Problems on fleet management, Fleet maintenance, Planning - Scheduling operation & control, Personal & training-training for drivers & conductors, Public relations, Propaganda, publicity and passenger amenities, Parcel traffic., Theory of fares-Basic principles of fare charging, Differential rates for different types of services, Depreciation & debt charges, Operation cost and Revenues, Economics & records.	08
5	Goods Transport Operation: Structure of goods transport organizations, Scheduling of goods transport, Management Information System (MIS) in passenger / goods transport operation, Storage & transportation of petroleum products.	07
6	Advance Techniques in Traffic Management: Traffic navigation, Global positioning system	04
7	Road cross section design, Speed breaker design: Composition of road structure, Elements of cross sections, Rural road standards, urban road standards, Speed breaker dimension, material, characteristics, applications, Speed breakers inside residential localities, Speed breakers for highway cross sections, Rubber speed breakers, Plastic speed breakers.	05

Learning Outcomes:

- Upon completion of the course students will know about different aspects related to transport system and management.
- Know about the motor vehicle act and maintenance aspects of transport.

Books Recommended:

1. The Motor Vehicle Act, 1988; Govt. of India Publication.
2. Transport Development in India by **S. K. Shrivastava**, S. Chand & Co. Pvt. Ltd., New Delhi.
3. Road Passenger Transport in India by **P. G. Patankar**, CIRT, Pune

Reference Books:-

1. Productivity in Road Transport by **Santosh Sharma**, 2nd Edition, Association of State Road Transport Undertakings, New Delhi.
2. Economics of Transport by **S.K Shrivastava**.
3. Fleet maintenance by **John Doice**, Mcgraw Hill, New York, 1984
4. Motor transportation by **Hudson**, TMH.
5. Journals of Indian Road Congress.