

YEAR IV, SEMESTER-VII											
B.Tech. Automobile Engineering (Effective from session 2016-17)											
S. No.	Course Code	Subject	Periods			Evaluation Scheme				Subject Total	Credit
			L	T	P	Sessional Exam			ESE		
						CT	TA	Total			
THEORY											
1.	NOE-071 to 074	Open Elective-I	3	1	0	30	20	50	100	150	4
2.	NAU-031 to 033	Department Elective-III	3	1	0	30	20	50	100	150	4
3.	NAU-041 to 043	Department Elective-IV	3	1	0	30	20	50	100	150	4
4.	NAU-701	Computer Aided Design and Manufacturing	3	1	0	30	20	50	100	150	4
5.	NAU-702	Automotive Pollution and Control	3	1	0	30	20	50	100	150	4
PRACTICAL											
6.	NAU-751	CAD/CAM Lab	0	0	2	10	10	20	30	50	1
7.	NAU-752	Automotive Pollution and Control Lab	0	0	2	10	10	20	30	50	1
8.	NAU-753	Industrial Training Evaluation and Viva-Voce	0	0	2	-	50	50	-	50	1
9.	NAU-754	Project Work	0	0	3	-	50	50	-	50	2
10.	NGP-701	General Proficiency	-	-	-	-	-	50	-	50	-
		Total	15	5	09	-	-	-	-	1000	25

Note-***Practical Training-1 & 2 (4 weeks each) done after 4th and 6th Semester would be evaluated in 7th semester through Report and Viva voce etc.

Project should be initiated in 7th semester beginning, and should be completed by the end of 8th semester with good Report and to be presented through Power Point Presentation.

Open Electives – I

- NOE-071 Entrepreneurship Development
- NOE-072 Quality Management
- NOE-073 Operations Research
- NOE-074 Introduction to Biotechnology

Department Elective-III:

- NAU-031 Vehicle Body Engineering and Safety
- NAU-032 Automotive Aerodynamics
- NAU-033 Automotive Transmission

Department Elective-IV:

- NAU-041 Advanced Automobile Technologies
- NAU-042 Automotive Air Conditioning
- NAU-043 Special Purpose Vehicles

YEAR IV, SEMESTER-VIII											
B.Tech. Automobile Engineering (Effective from session 2016-17)											
S. No.	Course Code	Subject	Periods			Evaluation Scheme				Subject Total	Credit
			L	T	P	Sessional Exam			ESE		
						CT	TA	Total			
THEORY											
1.	NOE-081 to 084	Open Elective-II	3	1	0	30	20	50	100	150	4
2.	NAU-051 to 053	Department Elective-V	3	1	0	30	20	50	100	150	4
3.	NAU-061 to 063	Department Elective-VI	3	1	0	30	20	50	100	150	4
4.	NAU-801	Trouble Shooting, Servicing and Maintenance of Automobiles	3	1	0	30	20	50	100	150	4
PRACTICAL											
5.	NAU-851	Seminar	0	0	3		50	50	--	50	2
	NAU-852	Project	0	0	12	-	100	100	200	300	7
6.	NGP-801	General Proficiency	-	-	-	-	-	50	-	50	-
		Total	12	4	15	-	-	-	-	1000	25

Open Electives – II

NOE-081 Non Conventional Energy Resources

NOE-082 Nonlinear Dynamic Systems

NOE-083 Product Development

NOE-084 Automation and Robotics

Department Elective-V:

NAU-051 Noise, Vibration and Harness

NAU-052 Alternate Energy Sources for Automobiles

NAU-053 Vehicle Dynamics

Department Elective-VI:

NAU-061 Computer Simulation of I.C. Engines

NAU-062 Finite Element Method

NAU-063 Hydraulic and Pneumatic Systems

ANNEXURE-II

SYLLABUS

NAU-701 COMPUTER AIDED DESIGN AND MANUFACTURING L T P
3 1 0

UNIT I

Computers in Industrial Manufacturing: Product cycle, CAD / CAM Hardware, Basic structure, CPU, Memory types, Input devices, Display devices, Hard copy devices, Storage devices.

Computer Graphics: Raster scan graphics coordinate system, Database structure for graphics modeling, Transformation of geometry, 3D transformations, Mathematics of projections, Clipping, Hidden surface removal.

UNIT II

Geometric Modeling: Requirements, geometric models, Geometric construction models, Curve representation methods, Surface representation methods, Modeling facilities desired.

Drafting and Modeling systems: Basic geometric commands, layers, Display control commands, Editing, dimensioning, Solid modeling.

UNIT III

Numerical Control: NC, NC modes, NC elements, NC machine tools, structure of CNC machine tools, Features of Machining center, turning center.

CNC Part Programming: Fundamentals, manual part programming methods, Computer Aided Part Programming.

UNIT IV

Group Tech: Part family, coding and classification, production now analysis, advantages and limitations, Computer Aided Processes Planning, Retrieval type and Generative type.

Computer aided Quality Control: Terminology in quality control, The computer in ac, Contact inspection methods, Non-contact inspection methods, optical non-contact inspection methods, non-optical, computer aided testing, integration of CAQC with CAD/CAM.

UNIT V

Computer integrated manufacturing systems: Types of Manufacturing systems, Machine tools and related equipment, material handling systems, computer control systems, human labor in the manufacturing systems, CIMS benefits.

Text Books

1. CAD / CAM A Zimmers&P.Groover/PEIPHI
2. CAD / CAM Theory and Practice /Ibrahim Zeid / TMH

References:

1. Automation, Production systems & Computer integrated Manufacturing! Groover/P.E
2. CAD / CAM / CIM / Radhakrishnan and Subramanian / New Age
3. Principles of Computer Aided Design and Manufacturing / Farid Amirouche / Pearson
4. CAD/CAM: Concepts and Applications/Alavalal PHI
5. Computer Numerical Control Concepts and programming / Warren S Seames / Thomson

UNIT I

Introduction: History back ground, exhaust gas pollutants, Vehicle population assessment in metropolitan cities and contribution to pollution, effect on human health and environment, global warming, Green house effect.(8)

UNIT II

SI engine Combustion and Pollutant Formation: Chemistry of SI engine Combustion, HC and CO formation in Four stroke and Two stroke SI engines, NO formation in SI Engines, Effect of operating variables on emission formation.(8)

UNIT III

CI engine Combustion and Emissions: Basic of diesel combustion, Smoke emission in diesel engines, Particulate emission in diesel engines. Colour and aldehyde emissions from diesel engines, Effect of operating variables on emission formation.(8)

UNIT IV

Control Techniques for SI and CI: Design changes, optimization of operating factors, exhaust gas recirculation, control of evaporative emission, air injector PCV system-Exhaust treatment in SI engines-Thermal reactors-Catalytic converters, Catalysts, Use of unleaded petrol. Diesel particulate filter (8)

UNIT -5**Emission Measurement and standards:**

Measurement of CO₂ and CO by NDIR analyzer, Measurement of Hydrocarbon emission by Flame ionization detectors, Measurement of NO_x by Chemiluminescent analyzer, Gas chromatograph, Smoke meters, Emission standards. driving cycles– USA, Euro and India. Test procedures – ECE, FTP tests. (8)

References

1. Mathur M. L., Internal Combustion Engines
2. Ganesan. V., Internal Combustion Engines, Tata McGraw Hill Co.
3. Obert. E.F., Internal Combustion Engines.
4. Taylor. C.F., Internal Combustion Engines, MIT Press.
5. Heywood. J.B., Internal Combustion Engine Fundamentals, McGraw Hill Book Co.

NAU-751 CAD/CAM LAB
0 0 3

L T P

1. Drafting: Development of part drawings for various components in the form of orthographic and isometric. Representation of Dimensioning and tolerances scanning and plotting. Study of script, DXE and IGES FILES.
2. Part Modeling: Generation of various 3D Models through Protrusion, revolve, shell sweep. Creation of various features. Study of parent child relation. Feature based and Boolean based modeling surface and Assembly Modeling Study of various standard Translators. Design simple components.
3.
 - a) Determination of deflection and stresses in 2D and 3D trusses and beams.
 - b) Determination of deflections component and principal and Von-mises stresses in plane stresses in plane stress, plane strain and Axisymmetric components.
 - c) Determination of stresses in 3D and shell structures (at least one example in each case).
 - d) Estimation of natural frequencies and mode shapes. Harmonic response of 20 beam.
 - e) Steady state heat transfer Analysis of plane and Axis symmetric components.
4.
 - a) Development of process sheets for various components based on tooling Machines.
 - b) Development of manufacturing detects and tool management systems.
 - c) Study of various post processors used in NC Machines.
 - d) Development of NC code for free form and sculptured surfaces using CAM packages.
 - e) Machining of simple components on NC lathe and Mill by transferring NC Code / from a CAM package through RS 232.
 - f) Quality Control and inspection.

Packages: Use of Auto CAD, Micro Station, CATIA, Pro-E, 1-DEAS, ANSYS. NISA, CAEFEM, IBBS CAM, Master CAM etc.

NAU 752 AUTOMOTIVE POLLUTION AND CONTROL LAB L T P
3 10

1. Study of Pressure pickups, charge amplifier, storage oscilloscope and signal analyzers used for IC engine testing.
2. Performance study of petrol and diesel engines both at full load and part load conditions.
3. Morse test on petrol and diesel engines.
4. Determination of compression ratio, volumetric efficiency and optimum cooling water flow rate in engines.
5. Heat balance test on an automotive engine.
6. Testing of 2 and 4 wheelers using chassis dynamometers.
7. Study of NDIR Gas Analyser and FID
8. Study of Chemiluminescent NOx analyzer
9. Measurement of HC, CO, CO₂, O₂ using exhaust gas analyzer
10. Diesel smoke measurement

References

1. Giles. J.G., Vehicle Operation and performance, Hliffe Books Ltd., London, 1989.
2. Grouse. W.H. and Anglin. D.L., Motor Vehicle Inspection, McGraw Hill Book Co., 1978.
3. Ganesan. V., Internal Combustion engines, Tata McGraw Hill Co., 1994. 4JBIS code Books, IS-10000 series, 1988.

NAU 801 TROUBLE SHOOTING, SERVICING & MAINTENANCE OF AUTOMOBILES

310

UNIT I

Automobile Maintenance: Importance of maintenance, scheduled and unscheduled maintenance, preparation of check lists, analysis of breakdown, preventive measures, unit replacement system, maintenance schedule, chassis lubrication schedule, component retrieval, estimating repair cost, maintenance record, warranty period, servicing. Inspection forms, Log books, Trip sheets, Other maintenance record forms, Garage Practice: Types of service station/garage, layout of garage, Factors affecting layout, tools & equipments, transport service undertakings, design layout for different garage.
(8)

UNIT II

Engine Maintenance: Dismantling of engine components, cleaning methods, visual inspection and dimensional check of various engine components, minor and major tune up, reconditioning and repairing methods of engine components, Assembly procedure, special tools used for maintenance, repair and overhauling, Cooling Systems, Anti corrosion and antifreeze solutions, radiator, and thermostat, Lubrication oil topping up, oil change, oil relief valve, fuel feed systems, FIP adjustment and testing, injector testing.
(10)

UNIT III

Chassis and Drive Line Maintenance: Mechanical type gear box, Automatic type gear box, Final reduction, propeller shaft, front and rear suspension systems, Brake systems: hydraulic, servo, air etc., Air bleeding, steering system, axles, wheel alignment, tires.
(8)

UNIT IV

Electric System Maintenance: Battery testing method, starter motor, Charging system: DC generator, AC alternator, regulator, Ignition system: coil ignition, transistor assisted ignition, capacitor discharge ignition, Electric horn, wiper motor, flasher, electric fuel pump, gauges, Lighting system, head lights focusing, wiring harness testing.
(8)

UNIT V

Body Repair : Minor body panel beating, tinkering, shouldering, Painting: Introduction of automotive paints, types of paints, corrosion and anticorrosion method, rubbing, polishing, working of paint booth, door lock mechanism, window glass actuation mechanism.
(8)

Text Books

1. John Doke "Fleet Management", McGraw-Hill Co. 1984.
2. Maleev. V.L., "Diesel Engine operation and Maintenance", Maintenance, McGraw Hill book Co., New York, 1954.

References

1. Judge. A.N., "Motor vehicle engine servicing, 3rd, Edition", Pitman Paperpack, London, 69.
2. Judge. A.W., "Maintenance of High speed diesel engines", Chapman Hall Ltd., London, 56.
3. John. W. Vale. J.R., "Modern Aut Body and Finder repair".
4. Venk. Spicer. "Automotive Maintenance and Trouble shooting".
5. "Vehicle Service Manuals of reputed manufactures".

DEPARTMENT ELECTIVE-III

NAU-031VEHICLE BODY ENGINEERING AND SAFETY L T P

3 1 0

UNIT I

Materials

Structural materials: Aluminum alloy sheet, extrusion and casting, Austenitic and Ferritic stainless steels, alloy steels. Different types of composites, FRP & metal Matrix Composites. Structural timbers properties designing in GRP and high strength composites different manufacturing techniques of composites. Thermo plastics, ABS and styrenes, Load bearing plastics, semi rigid PUR foams and sandwich panel construction.

UNIT II

Ergonomics and Controls

Shaping and packaging: Product design and concepts, Aesthetics and industrial design, formal aesthetics and shape, computer aided drafting, surface development, interior ergonomics, ergonomics system design, dashboard instruments, advances in electronic display, CV legal dimension. CV-cab ergonomics, mechanical package layout. Body Fitting and I Controls: Driver's seat, window winding mechanism, Door lock mechanism, other interior mechanisms, driver's visibility' and tests for, visibility, minimum space, requirements and methods or improving space in cars, electric wiring and electronic control systems, advanced body electronics, networking or body systems controls.

UNIT III

Aerodynamics and Force Analysis

Aerodynamics: Basics, aerofoils, aerodynamics drag lift, pitching, yawing and rolling moments, determination of aerodynamic coefficients (wind tunnel testing), racing car aerodynamics, bluff body aerodynamics, local air flows. Load Distribution: Types of load carrying structures -closed, integral, open, flat types. Calculation of loading cases-static, asymmetric, vertical loads. Load distribution, stress analysis of structure, body shell analysis.

UNIT IV

Structural Dynamics

Noise, Vibration, Harshness: Noise and vibration basics, body structural vibrations, chassis bearing vibration, designing against fatigue, rubber as an isolator. CV body mountings, automatic enclosures, sandwich panels, structure dynamics applied, surety under impact: Impact protection basics, design for crash worthiness, occupant and cargo restraints. Passive restraint systems, slide impact analysis, bumper system, energy absorbent foams, laws of mechanisms applied 10 safeties.

Vehicle stability: Steering geometry vehicle and a curvilinear path, and lateral stability, effects of tyre factors, mass distribution and engine location on stability.

UNIT V

Types of Vehicles

Vans, trucks and buses: Types of mini coach with trailers, single and double deckers, design criteria based on passenger capacity, goods to be transported and distance to be covered, constructional details, weights and dimensions, conventional and integral type.

Text / References Books:

1. Body Engineering -Sydney F Page
2. Vehicle Body Engineering -Giles J Pawlowski
3. Automotive Chassis -P.M. Heldt. chilton & Co.

4. Handbook on Vehicle Body Design -SAE Publications.

NAU 032 AUTOMOTIVE AERODYNAMICS

L TP
3 10

UNIT I

Introduction

Scope, Historical development trends, Fundamental of fluid mechanics, Flow phenomenon related to vehicles External & Internal flow problem, Resistance to vehicle motion, Performance, Fuel consumption and, performance, Potential of vehicle aerodynamics.

UNIT-II

Aerodynamic Drag of Cars

Cars as a bluff body, Flow field around car, drag force, types of drag force, analysis of aerodynamic drag, drag coefficient of cars, strategies for aerodynamic development, low drag profiles.

UNIT-III

Shape Optimization of Cars

Front end modification, front and rear wind shield angle, Boat tailing, Hatch back, fast back and square back, Dust flow patterns at the rear, effects of gap configuration, effect of fasteners.

UNIT-IV

Vehicle Handling

The origin of forces and moments on a vehicle, side wind problems, methods to calculate forces and moments, vehicle dynamics under side winds, the effects of forces and moments, Characteristics of forces and moments, Dirt accumulation on the vehicle, wind noise, drag reduction in commercial vehicles.

UNIT-V

Wind Tunnels for Automotive Aerodynamic

Introduction, Principle of wind tunnel technology, Limitation of simulation, Stress with scale models, full scale wind tunnels, measurement techniques, Equipment and transducers, road testing methods, Numerical methods.

Text / References Books:

1. Hucho.W.H., "Aerodynamic of Road vehicles ", Butterworths Co. Ltd., 1997.
2. Pope. A., " Wind Tunnel Testing ", John Wiley & Sons, 2ndEdn, New York, 1974.
3. Automotive Aerodynamic: Update SP-706, SAE.

NAU-033 AUTOMOTIVE TRANSMISSION L T P

3 1 0

UNIT-I

Transmission requirements: requirements of transmission system, general arrangement of power transmission, general arrangement of rear-engine vehicle with live axles, general arrangement of dead- axle and axles transmission; four-wheel-drive transmission.

UNIT-II

Clutches Requirements of clutches, principle of friction clutches, types of clutches and materials used- cone, single-plate, diaphragm-spring, multi-plate, centrifugal, over-running and electromagnetic clutch.

UNIT-III

Gear box: Need of gear boxes, types- sliding mesh, constant mesh and epicyclic, gear boxes; synchronizers: principle, early and later Warner synchronizer, Vauxhall synchronizer- gear materials lubrication and design of gear box; Hydrodynamic drive: Advantages and limitations, principle of fluid coupling, constructional details, torque-capacity performance characteristics, drag torque, methods of minimizing drag torque; Torque converter: performance characteristics; single, multistage and poly phase torque converters, converter-coupling- performance characteristics, coupling-blade angle and fluid flow, converter fluid.

UNIT-IV

Transmission systems-Drive line: Definition, forces & torques acting; types of drives- Hotchkiss, torque tube & radius rod drives; components- propeller shaft, slip joint, universal joints & constant velocity universal joints; front wheel drive; Final drive: definition; types- worm- wheel, straight-bevel gear, spiral-bevel gear & hypoid-gear drives; double-reduction & twin- speed final drives; Differential: Function, principle, construction and working; non-slip differential; differential lock; rear axle- loads acting & types; multi-axled vehicles.

UNIT-V

Automatic transmission: Chevrolet “turbo glide” transmission, power glide transmission, hydraulic control system of automatic transmission; Electric drive: advantages and limitations, principle of early and modified Ward-Leonard system, modern electric drive for buses; performance characteristics.

Text / References Books:

- 1 Heldt P.M.; Torque converters; Chilton Book Co.
- 2 Giri NK; Automobile Engineering; Khanna Publisher.
3. Newton, Steeds & Garret; Motor Vehicles; B.H. Publication.
4. Judge, A.W., Modern Transmission Systems, Chapman & Hall Ltd.
5. Check Chart; Automatic Transmission; Harper & Row Publication.

DEPARTMENT ELECTIVE-IV

NAU-041 ADVANCED AUTOMOBILE TECHNOLOGIES L T P

3 1 0

UNIT I

The future of the Automotive Industry : Challenges and Concepts for the 21st century. Crucial issues facing the industry and approaches to meet these challenges. Fuel Cell Technology For Vehicles: What is fuel cell, Type of fuel cell, Advantages of fuel cell. Current state of the technology. Potential and challenges. Advantages and disadvantages of hydrogen fuel. Hybrid vehicles - Stratified charged / lean burn engines - Hydrogen engines - battery vehicles – Electric propulsion with cables - Magnetic track vehicles.

UNIT II

Latest Engine Technology Features: Advances in diesel engine technology. Direct fuel injection Gasoline engine. Diesel particulate emission control. Throttling by wire. Variable Valve Timing, Method used to effect variable Valve Timing. Electromagnetic Valves, Cam less engine actuation.

UNIT III

42 Volt System: Need, benefits, potentials and challenges. Technology Implications for the Automotive Industry. Technological evolution that will occur as a result of the adoption of 42 volt systems. Power system; power steering, power brakes, windows, Automated systems; computer controlled front collision prevention, navigation, GPS, engine check diagnosis system, wheel status air pressure, alignment, number of liters of diesel left, kilometers to be covered, mileage at each discrete interval. Preparation and maintenance of proper road network - National highway network with automated roads and vehicles - Satellite control of vehicle operation for safe and fast travel. Computer Control for pollution and noise control and for fuel economy - Transducers and actuators - Information technology for receiving proper information and operation of the vehicle like optimum speed and direction.

UNIT IV

Electrical And Hybrid Vehicles : Types of hybrid systems, Objective and Advantages of hybrid systems. Current status, Future developments and Prospects of Hybrid Vehicles Integrated Starter Alternator: Starts stop operation, Power Assist, Regenerative Braking. Advanced lead acid batteries, Alkaline batteries, Lithium batteries. Development of new energy storage systems. Deep discharge and rapid charging ultra capacitors.

UNIT-V

X-By Wire Technology: What is X-By Wire, Advantage over hydraulic systems. Use of Automotive micro controllers. Types of sensors. Use of actuators in an automobile environment. Vehicles Systems: Constantly Variable Transmission, Benefits, Brake by wire, Advantages over power Braking System. Electrical assist steering, Steering by wire, Advantages of Steering by wire. Semi-active and fully-active suspension system, Advantages of fully active suspension system.

Text / References Books:

1. Advanced Vehicle Technologies by Heinz Heisler- SAE International Publication.
2. Electric and Hybrid Electric vehicles by Ronald K. Jurgen.- SAE International Publication\
3. Electronic Braking, Traction and Stability control- SAE Hardbound papers.
4. Electronics steering and suspension systems- SAE Hardbound papers.
5. 42 Volt system by Daniel J. Holt- SAE International Publication
6. Diesel Particulate Emission by J.H. Johnson- SAE Hardbound papers.
7. Fuel Cell Technologies for vehicles by Richard Stobart- SAE Hardbound papers.

NAU-042 AUTOMOTIVE AIR CONDITIONING L T P

3 1 0

UNIT I

Air-Conditioning Fundamentals

Basic air conditioning system, Location of air conditioning components in a car, Schematic layout of a refrigeration system, Compressor components, Condenser and high pressure service ports, Thermostatic expansion valve, Expansion valve calibration, Evaporator pressure regulator, Evaporator temperature regulator, receiver, drier, accumulators, refrigerant hoses, Connections and other assemblies.

UNIT II

Automotive Cooling and Heating System

Heating system, Automotive heaters, Manually controlled air conditioner, Heater system, Ford automatically controlled air, conditioner and heater systems, Automatic temperature control, Air conditioning protection, Engine protection.

UNIT III

Air-Conditioning Controls, Delivery System and Refrigerants

Types of Control devices, Preventing Compressor damage, Preventing damage to other systems, Maintaining driveability, Preventing Overheating, Ram air ventilation, Air delivery Components, Control devices- Vacuum Controls, Containers, Handling refrigerants, Discharging, Charging & Leak detection, Refrigeration system diagnosis, Diagnostic procedure, Ambient conditions affecting system pressures.

UNIT IV

Automatic Temperature Control

Different types of sensors and actuators used in automatic temperature control- Fixed and variable displacement temperature control- Semi Automatic- Controller design for Fixed and variable displacement type air conditioning system

UNIT-V

Air Conditioning Service

Air conditioner maintenance and service, Special tools for servicing vehicle air conditioning, Servicing heater system, Removing and replacing components, Troubleshooting of air conditioning system, Compressor service.

Text / References Books:

1. William H Grouse and Donald L Anglin, " Automotive Air conditioning ", McGraw-Hill Inc., 1990.
2. Warren Farnell and James D.Halderman, "Automotive Heating, Ventilation, and AirConditioning systems", Classroom Manual, Pearson Prentice Hall, 2004
3. Warren Farnell and James D.Halderman, "Automotive Heating, Ventilation, and AirConditioning systems", Shop Manual, Pearson Prentice Hall, 2004
4. William H Crouse and Donald L Anglin, "Automotive Air conditioning", McGraw Hill Inc., 1990.
5. Mitchell information Services, Inc, " Mitchell Automatic Heating and Air ConditioningSystems ", Prentice Hall Ind., 1989.
6. Paul Weiser, " Automotive Air Conditioning ", Reston Publishing Co Inc., 1990.
7. MacDonald, K.L., " Automotive Air Conditioning ", Theodore Audel series, 1978.
8. Goings. L.F., Automotive Air Conditioning ", American Technical services, 1974.

NAU-043 SPECIAL PURPOSE VEHICLES L T P

3 1 0

UNIT I

Classification of tractors, layout of wheeled tractor, power transmission system, steering system, accessories of wheeled tractors, power take off unit, hitch, winch mechanism, hydraulic control system, lift and draft control of implements, agricultural applications of tractors like sprayer, threshers, seed and fertilizer application, crop cultivation.

UNIT II

Various earth moving machines, working of Bulldozers, Dumpers, Loaders, Scrapers & Shovels, methods of loading and unloading operations involved, constructional features of earth moving equipment, actuation of implements using cable control, hydraulic control, different types of buckets involved in loader.

UNIT III

Various construction vehicles-systems of road rollers, excavator, grader, road roller classifications, ballasting of road roller wheels, different types of compacting - sheep foot drum, vibrating type, construction and uses of excavator, applications and classification of grader, mechanism of mobile crane and truck mounted crane.

UNIT IV

Features of Oil tankers, Articulated vehicles, working, features of Ambulance, features of fire extinguishing vehicle, working of Hover craft, working of fork lift, features of campervan.

UNIT V

Ergonomic applications in man-machine and animal system: Human factors in special purpose vehicle design with reference to comfort, convenience and safety, effects of noise, vibration and thermal stresses on human performance. Economics of special purpose vehicle utilization.

Text / References Books:

1. C.P.Nakra –Tractors - DhanpatRai Publishers
2. S.C.Sharma - Construction equipment - Khanna publishers
3. Donnell hunt and L .W.garver - Farm machinery and mechanism - Iowa state university press
4. J.Y Wong - Theory of Ground vehicles - John Wiley and Sons

DEPARTMENT ELECTIVE-V

NAU-051 NOISE, VIBRATION AND HARSHNESS

L T P

3 1 0

UNIT I

Fundamentals of Acoustics and Noise, Vibration

Theory of sound: Predictions and measurement, sound sources, sound propagation in the atmosphere, sound radiation from structures and their response to sound, general introduction to vibration, vibration of simple discrete and continuous systems, random vibration, response of systems to shock, passive damping.

UNIT II

Effects of Noise, Blast, Vibration, and Shock on people

General introduction to noise and vibration, Effects on people and hearing conservation, Sleep disturbance due to transportation noise exposure, Noise-induced annoyance, Effects of infrasound, Low-frequency noise and ultrasound on people, Auditory hazards of impulse and impact noise, Effects of intense noise on people and hearing loss, Effects of vibration on people, Effects of mechanical shock on people, Rating measures, descriptors, criteria, and procedures for determining human response to noise.

UNIT III

Transportation Noise and Vibration: Sources, Prediction, and Control

Introduction to Transportation Noise and Vibration, Sources, Internal Combustion Engine Noise Prediction and Control, Diesel exhaust and intake noise and acoustical design of mufflers, Tire/Road Noise: Generation, Measurement, and Abatement, Aerodynamic Sound Sources in Vehicles: Prediction and Control, Transmission, Gearbox Noise, Vibration, prediction and control, Brake Noise Prediction and Control.

UNIT IV

Interior Transportation Noise and Vibration Sources: Prediction and Control

Introduction to Interior Transportation Noise and Vibration Sources, Automobile, Bus, and Truck Interior Noise and Vibration Prediction and Control, Noise and Vibration in Off-Road Vehicle Interiors-Prediction and Control.

UNIT V

Noise and Vibration Transducers, Analysis Equipment, Signal Processing, and Measuring Techniques

General introduction to Noise and Vibration Transducers, Measuring Equipment, Measurements, Signal Acquisition, and Processing, Acoustical Transducer Principles and Types of Microphones, Vibration Transducer Principles and Types of Vibration Transducers, Sound Level Meters, Noise Dosimeters, Analyzers and Signal Generators, Equipment for Data Acquisition, Noise and Vibration Measurements, Determination of Sound Power Level and Emission Sound Pressure Level, Sound Intensity Measurements, Noise and Vibration Data Analysis, Calibration of Measurement Microphones, Calibration of Shock and Vibration Transducers, Metrology and Traceability of Vibration and Shock Measurements.

Text Books

1. Clarence W. de Silva , “Vibration Monitoring, Testing, and Instrumentation “,CRC Press, 2007
2. David A.Bies and Colin H.Hansen “Engineering Noise Control: Theory and Practice “Spon Press, London, 2009

References

1. Allan G. Piersol ,Thomas L. Paez “Harris’ Shock and Vibration Handbook”, McGraw-Hill, New Delhi, 2010
2. Colin H Hansen “Understanding Active Noise Cancellation“ ,Spon Press , London 2003

3. Matthew Harrison "Vehicle Refinement: Controlling Noise and Vibration in Road Vehicles", Elsevier Butterworth-Heinemann, Burlington, 2004.

NAU 052 ALTERNATIVE ENERGY SOURCES FOR AUTOMOBILES

L TP

3 1 0

UNIT I

Introduction: Need for non conventional energy sources, Energy alternative: solar, photo-voltaic, Hydrogen, Bio mass, Electrical etc., their merits and demerits. Solar photo-voltaic conversion, Collection and storage of solar energy, collection devices, flat plate collectors, concentrating type collectors, principles and working of photo-voltaic conversion, Applications to automobiles.

UNIT II

Energy from Bio mass: Photosynthesis, photosynthetic oxygen production, energy plantation. Bio gas production from organic waste, description of Bio gas plant, types of Bio gas plants, problems involved in production and transportation. Application of Bio gas in engines as a single fuel and dual fuel modification, merits and demerits performance characteristics and their comparison.

UNIT III

Hydrogen Energy: Properties of hydrogen, sources of hydrogen, Thermodynamics of water splitting, production of hydrogen, electrolysis of water, thermal decomposition of water, thermo-chemical production, biochemical production, Hydrogen fuel: Storage and Transportation methods, Applications to engines and necessary modifications, precautions and safety measures, performance characteristics in engine and their comparison.

UNIT IV

Electric Automobiles: Design considerations, limitations, opportunities for improvement, batteries, problems, future possibilities, capacities, types, material requirement, Applicability of electric cars, comparative use of fuel and energy, availability of energy for recharging, impacts on use of fuel and energy, impact on urban air quality, impact on price, material requirement, traction motors and types.

UNIT V

Vegetable Oils: Various vegetable oils for engines, esterification, performance in engines, performance and emission characteristics, use of gas turbines in cars, arrangement, control merits and demerits, design of turbochargers for automobiles, their usefulness on the performance.

Text Books:

1. G.D. Rai "Non-conventional sources of energy Khanna Lab.
2. William Hamilton 'Electric Automobiles', PHI

Reference Books:

1. S.P. Sukhatme 'Solar Energy', Tata McGraw Hill
2. .S. Rao & B.B. Larulekar 'Energy Technology', Khanna Lab
3. Frank Kreith & Jan F. Krieder 'Principles of Solar Engineering' McGraw Hill.
4. J.A. Duffie & W.A. Beckman 'Solar Energy -thermal Process' McGraw Hill
5. T.N. Veziroglu. Alternative energy sources.

NAU 053 VEHICLE DYNAMICS

L T P

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UNIT-I

Undamped free vibration: Single degree of freedom, Systems, introduction, undamped free vibration, Natural frequency' of free vibration, Rayleigh's method, stiffness of spring elements, effects of spring mass, Energy method, Newton's method and D' Alembert' s principle- problems.

UNIT-II

Damped free vibration: Single degree of freedom systems, different types of damping, concept of critical damping and its importance, response study of viscous damped systems for cases of under damping and over damping, logarithmic decrement.

UNIT-III

Forced vibration: Single degree of freedom systems, steady state solution with viscous damping due to harmonic force solution by complex algebra, concept of response, reciprocating and rotating unbalance, vibration isolation Transmissibility ratio, energy dissipated by damping equivalent, viscous damping, structural damping, sharpness or resonance, base excitation.

UNIT-IV

Vibration measuring instruments, Accelerometers and vibrometers, whirling of shafts with and without air damping, discussion of speeds above and below critical speeds, Systems with two degree of freedom: Introduction, principle modes and normal modes, co-ordinate coupling, generalized and principle co-ordinate, free vibrations in terms of natural conditions, Lagranges equation, semi-definite systems, forced oscillations, harmonic excitation.

UNIT-V

Different types of tyres, cross ply tyre, radial ply tyre, belted bias tyre, tubed tyre, tubeless tyre, Materials used: Tyre construction, tyre damage and defects, Tyre characteristics, tyre specification coding system, different types of wheels, disc wheel, pressed steel disc wheel, cast light alloy wheel, wire spoked wheel, wheel balancing, wheel construction, wheel dimensions.

Textbooks

1. Mechanical Vibration -By O.K. Grover, Nemchand& Brothers
2. Vibration Theory & Applications -By William I Thomson, Prentice Hall
3. Theory & Problems of Mechanical Vibration -By William W. Seto, McGrawHill
4. Problems in Automobile Mechanics-By N.K.Giri, Khanna Pub.
5. Mechanics of Pneumatic Tyre -By S.K.Cfark, Prentice Hall
6. Mechanical Vibration Analysis -By P. Srinivasan, TMH
7. Mechanical Vibration -By Church. Wife) international

DEPARTMENT ELECTIVE-VI

NAU-061 COMPUTER SIMULATION OF IC ENGINESL T P

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Unit I

Introduction

Heat of reaction, Measurement of URP, Measurement of HRP, Adiabatic flame temperature: Complete combustion in C/H/O/N Systems, Constant volume adiabatic combustion, constant pressure adiabatic combustion, Calculation of adiabatic flame temperature, Isentropic changes of state.

Unit II

SI Engine Simulation with air as working medium

Deviation between actual and ideal cycle, Problems, SI engine simulation with adiabatic combustion, temperature drop due to fuel vaporization, full throttle operation, efficiency calculation, part-throttle operation, super charged operation.

Unit III

Progressive Combustion

SI Engines simulation with progressive combustion with gas exchange process, Heat transfer process, friction calculation, compression of simulated values, validation of the computer code, engine performance simulation, pressure crank angle diagram and other engine performance.

Unit IV

Simulation of 2-stroke SI engine

Simulate the performance, unbalanced forces on two stroke engine.

Unit V

Diesel Engine Simulation

Multi zone model for combustion, different heat transfer models, equilibrium calculations, simulation of engine performance, simulation for pollution estimation.

References:

1. Ganesan.V. " Computer Simulation of spark ignition engine process ", Universities Press (I) Ltd, Hyderabad, 1996.
2. Ramoss.A.L., " Modelling of Internal Combustion Engines Processes ", McGraw Hill Publishing Co., 1992.
3. Ashley Campbel, " Thermodynamic analysis of combustion engines ", John Wiley & Sons, New York, 1986.
4. Benson.R.S.,whitehouse.N.D., " Internal Combustion Engines ", Pergamon Press, oxford, 1979.

NAU-062 FINITE ELEMENT METHOD

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UNIT I

Introduction

Introduction to finite difference method and finite elements method, Advantages and limitations, Mathematical formulation of FEM, Different approaches in Finite Element Method, Direct Stiffness approach, simple examples, Variational approach, Elements of variational calculus, Euler Lagrange equation, Rayleigh Ritz method, Weighted Residual methods, Point Collocation method, Galerkin method - Steps involved in FEM.

UNIT II

Types of Elements Used

Interpolation Polynomials, Linear elements, Shape function, Analysis of simply supported beam, Element and Global matrices, Two-dimensional elements, triangular and rectangular elements, Local and Natural Co-ordinate systems.

UNIT III

Finite Element Formulation of Field Problems

1-D and 2-D heat transfer, fluid flow (incompressible and non viscous fluid) in ducts, Simple electrical and magnetic field problems, Simple Numerical examples

UNIT IV

Finite Element Formulation of Solid Mechanics Problems

1-D problem of shaft; Truss element analysis of pinned truss, Plane stress/strain problems, Axisymmetric problems, thin plate problems, Vibration of shafts & beams.

UNIT V

Numerical Methods in FEM

Evaluation of shape functions, One dimensional & triangular elements, Quadrilateral elements, Isoperimetric elements, Numerical Integration, Gauss Legendre quadrature, Solution of finite element equations, Gauss Elimination Method, Cholesky decomposition.

Text Books

1. The Finite Element Method O.C. Zienkiewicz and R.L. Taylor McGraw Hill
2. An Introduction to Finite Element Method J. N. Reddy McGraw Hill
3. Finite Element Procedure in Engineering Analysis K.J. Bathe McGraw Hill
4. Finite Element Analysis C.S. Krishnamoorthy Tata McGraw Hill
5. Concepts and Application of Finite Element Analysis R.D. Cook, D.S. Malcus and M.E. Plesha John Wiley
6. Introduction to Finite Elements in Engineering T.R Chandragupta and A.D. Belegundu Prentice Hall India
7. Finite Element and Approximation O.C. Zenkiewicz & Morgan –
8. Numerical Methods by E. Balagurusamy Tata McGraw Hill

NAU-063 HYDRAULIC AND PNEUMATIC SYSTEMS

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UNIT I

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.

UNIT II

Fluid Kinematics and Fluid Dynamics

Fluid Kinematics, Flow visualization, lines of flow, types of flow, velocity field and acceleration, continuity equation (one and three dimensional differential forms), Equation of streamline, stream function, velocity potential function, circulation, flow net. Equations of motion, Euler's equation along a streamline, Bernoulli's equation applications to Venturi meter, Orifice meter, other flow measurement instruments, Pilot Tube etc.

UNIT III

Dimensional Analysis

Dimensional numbers, their application. - Buckingham's theorem - applications - similarity laws and models.

UNIT IV

Incompressible Fluidflow

Viscous flow, Navier-Stokes equation (Statement only), Shear stress, pressure gradient relationship, laminar flow between parallel plates, Laminar flow through circular tubes (Hagen Poiseuille's), Hydraulic and energy gradient flow through pipes, Darcy-Weisbach's equation, pipe roughness, friction factor, Moody's diagram, minor losses, flow through pipes in series and in parallel, power transmission, Boundary layer flows, boundary layer thickness, boundary layer separation, drag and lift coefficients.

UNIT -V

Hydraulic Turbines and Hydraulic Pumps, Compressor & Fans

Impact of jet on flat, curved & moving plates, Fluid machines: definition and classification exchange of energy, Euler's equation for turbo machines, Construction of velocity vector diagrams, head and specific work, component of energy transfer, degree of reaction.

Pumps: Definition and Classifications, Centrifugal pump: classifications, working principles, velocity triangles, specific speed, efficiency and performance curves, reciprocating pump: classification, working principles, indicator diagram., work saved by air vessels and performance curves, cavitations in pumps rotary, pumps: working principles of gear and vane pumps. Definition - Classification difference, efficiency, performance curves special application in Auto mobile Industries.

Textbooks

1. Fluid Mechanics and Hydraulics Machines (5th edition) by Bansal, R.K, Laxmi Publications (P) Ltd., New Delhi, 1995.
2. Fluid Mechanics by Streeter, V.L. and Wylie, E.B, McGraw-Hill, 1983
3. Hydraulic Machines- Theory and Design by Vasaadani, V.P., Khanna Publishers, 1992

Reference books

1. Fluid Mechanics & Machines, by D.S. Kumar, Katari publication.
2. Fluid Mechanics by White, E.M., Tata McGraw-Hill, 5* Edition, New Delhi, 2003