JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
DEPARTMENT OF AUTOMOBILE ENGINEERING

COURSE STRUCTURE-R19

COURSE STRUCTURE AND SYLLABUS

For

B. TECH AUTOMOBILE ENGINEERING

(Applicable for batches admitted from 2019-2020)

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IV Year - I Semester

Course Code	Subjects	L	T	P	Credits
ME4117	Industrial Engineering & Management	3	0	0	0
AU 4114	Vehicle Dynamics	3	0	0	3
AU 4115	Vehicle Body Engineering	3	0	0	3
AU 4116	Alternative Energy sources for Automobiles	3	0	0	3
ME 4118 AU 4117 AU 4118 ME 4119 AU 4119	**Elective I** 1. CAD/CAM 2. Two and Three Wheelers 3. Automotive Aerodynamics 4. Finite Element Methods 5. Vehicle Infotronics	3	0	0	3
ME 4120 ME 4121 ME 4122 ME 4123 CS 4101	**Elective II** 1. Mechatronics 2. Computational Fluid Dynamics 3. Condition Monitoring 4. Managerial Economics and financial analysis 5. Internet of Things	3	0	0	3
AU 4120	Vehicle Design and simulation Lab				2
PROJ 4103	Project I	0	0	6	2
	Total Credits				19

IV Year - II Semester

Course Code	Subjects	L	T	P	Credits
AU 4221	Noise, Vibrations and Harshness	3	0	0	3
AU 4222	Vehicle Maintenance	3	0	0	3
AU 4223	Certification and Homologation	3	0	0	3
AU 4224 AU 4225 AU 4226	**Elective III** I. Automotive Safety 2. Automotive HVAC 3. Special Purpose Vehicles	3	0	0	3
PROJ 4204	Project II	0	0	12	8
	Total Credits				20

Total Course Credits— 40+41 + 40+ 39 = 160

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IV Year - II Semester		L	T	P	C
		3	0	0	3
NOISE, VIBRATIONS AND HARSHNESS					

OBJECTIVES:
knowledge in basic of vibration and noise
Understanding the effect of noise an human comfort and environment
Knowing the methods of vibration and noise measurement.

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 and Gearbox Noise and 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,

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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, 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

OUTCOME:

At the end of the course, the student will understand the sources, effects, prediction, control techniques, measurement techniques of noise, vibration pertain to an automobile.

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IV Year - II Semester		L	T	P	C
		3	0	0	3
VEHICLE MAINTENANCE					

Course objectives: The students are exposed to maintain records and schedules, overhauling of engine components and various systems of a vehicle.

UNIT-I

Maintenance, Repair: Dismantling of engine components, cleaning methods, Visual inspection and dimensional check of various engine components, Identification of Recondition able & Discard able components, Reusable after minor repair.

Overhauling of engines: Minor and major tune up reconditioning, repairing methods of engine components, assembly procedure. Special tools used for maintenance, repair and overhauling.

UNIT-II

Maintenance, repair and servicing of cooling system, lubrication system:

Cooling system –Types of Cooling circuit, Types of water pumps, radiator,fans and thermostat valve, anti-corrosion and anti-freezing solutions, Coolant change intervals.

Lubricating system – Oil analysis, oil topping up, oil change intervals, Oil filters, Pressure relief valve, Bypass valve, Maintenance of air intake and exhaust system, Fuel System-Maintenance, Repair and servicing of fuel system-petrol, diesel fuel feed system components. Bleeding of air from fuel system.

UNIT-III

Maintenance, repair and servicing of electrical systems: Battery – testing methods. Starter motor. Charging system- DC generator, AC generator, Regulator, Ignition systems- coil ignition, transistor assisted ignition, capacitor discharge ignition. Electric horn, wiper, Flasher, electric fuel pump, gauges. Lighting system, head lights focussing. Wiring system.

UNIT-IV

Maintenance, repair and overhauling of chassis drive line components and suspensions systems: clutch – mechanical, automatic type gear box. Final reduction, Propeller shaft.

Suspension systems: front and rear suspension systems, Rigid and independent types, Brakes system – hydraulic, servo, servo assisted air braking, air bleeding. Steering system,

UNIT-V

Body repair tools, minor body panel beating, tinkering, soldering, polishing, painting. Door locks mechanism. Window glass actuating mechanism.

Wheel Alignment – Tyres: Maintence of tyres, tubes, flaps, valve caps, pressure in tyres, pattern of tyres-lug,semi lug, highway (Rib) and snow and mud pattern, Retreading of tyres. Rims classification, wheel balancing types.

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TEXT BOOKS:

1. Fleet management/ John Doke/McGraw Hill Co, 1984.
2. An Introductory Guide to Motor Vehicle Maintenance: Light Vehicles /Phil Knott, Adam Roylance/EMS Publishing, London.

COURSE OUTCOME: The students completing this course are expected to maintain various records and scheduled and unscheduled maintenance. They are also expected to maintain, repair and service of various systems of a vehicle.

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IV Year - II Semester		L	T	P	C
		3	0	0	3
CERTIFICATION AND HOMOLOGATION					

UNIT I
Introduction
Specification & Classification of Vehicles (including M, N and O layout), Regulations overview(ECE, EEC, FMVSS, AIS, CMVR, ADR), Type approval and Conformity of Production, Engine andVehicle specifications, Two Wheeler certification.

UNIT II
Vehicle Performance Testing:
Methods for evaluating vehicle performance- energy consumption in conventional automobiles, performance, emission and fuel economy, Operation of full load and part load conditions, effect of vehicle condition, tyre and road condition and traffic condition and driving habits on fuel economy, Gradability test, Turning circle diameter test, Steering Impact test, Steering effort test.

UNIT III
Road and Track Testing:
Initial inspection, PDI, engine running in and durability, intensive driving, maximum speed and acceleration, brake testing on the road, hill climbing, handling and ride characteristics, safety, mechanism of corrosion, three chamber corrosion testing, wind tunnel testing, road testing, test tracks.

UNIT IV
Active and Passive Safety Testing:
Wheel rim testing for cornering and radial fatigue, Fire resistance test, bumper test, crash test, side impact test, rollover test, safety belt test, Airbag test, Safety belt anchorages, Seat anchorages & head restraints, Occupant protection Impact test, Side door intrusion test.

UNIT V
Components Testing:
Size and Ply rating of tyres, Safety Glasses: Windscreen laminated safety glass, Side window / door glass, Back light / Rear toughened glass, Wind screen wiping system, Wiper Blade, Hydraulic brake hose, Hydraulic brake fluid, Rear view mirror specification (Exterior), Rear view mirror specification (Interior), Wheel rims, Wheel nut, Wheel discs & hub caps, Safety belt assemblies, Safety belt anchorages, Seat anchorages & head restraints, door locks & door retention.
overview and study of testing standards like; AIS testing standards, Euro Standards, SAE standards. ISO26262 standards for functional safety of electrical and/or electronic systems in automobiles.

TEXT BOOKS
1. Raymond M. Brach and R. Matthew Brach, "Vehicle Accident Analysis and ReconstructionMethods", SAE International, 2011
2. Automotive Industry Standards, AIS

REFERENCES
1. Ulrich Seiffert and Lothar Wech, “Automotive Safety Handbook”, SAE International, 2007
2. ISO Standards, ICS: 43.020, 43.040, 43.100

IV Year - II Semester		L	T	P	C

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		3	**0**	**0**	**3**
AUTOMOTIVE SAFETY (ELECTIVE – III)					

Course objective: To impart the knowledge of the safety concepts, comfort and convenience system, driver assistance system and other requirements of automotive safety**.**

UNIT-I
INTRODUTION:
Design of the body for safety, energy equation, engine location, deceleration of vehicle inside passenger compartment, deceleration on impact with stationary and movable obstacle, concept of crumble zone, safety sandwich construction.

UNIT-II
SAFETY AND FATIGUE ASPECTS
Design of body, forces in roll over, head on impact, plastics collapse and analysis, fatigue and vibration, test on box sections, structural vibration.

UNIT-III
SAFETY CONCEPT
Active safety: driving safety, conditional safety, perceptibility safety, operating safety- crash safety passive safety: exterior safety, interior, safety, deformation behaviour of vehicle body, speed and acceleration characteristics of passenger compartment on impact.
Safety equipment: Seat belt, regulations, automatic seat belt tightened system,Anti locking braking system(ABS), Speed limiting device(SLD),Fire detection and suppression system(FDSS), automatic traction control, automatic vehicle stability control, Collapsible steering system, tilt able steering system, air bags, electronic system for activating air bags, bumpers design for safety.

UNIT-IV
COLLISION WARNING AND AVOIDANCE
Collision warning system, causes of rear end collision, frontal object detection, rear vehicle object detection system object detection system with braking system interactions.

UNIT-V
COMFORT AND CONVENIENCE SYSTEM
Steering and mirror adjustment, central locking system, tyre pressure monitoring and control system, rain sensor system, automatic climate control systems, environment information system.

TEXT BOOKS:
1. Bosch /Automotive Handbook/5th edition /SAE publication
2. Junsz Pawlowski/Vehicle Body Engineering/Business book limited, 1989.
3. Ronald K Jurgen/Navigation and Intelligent Transportation Systems-Progress in Technology/ Automotive Electronics Series, SAE. USA,1998.

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REFERENCE BOOKS:

1. Rudolf Limpert/Brake Design and Safety/ SAE International, Second Edition, 1999.
2. Ronald. K. Jurgen / "Automotive Electronics Handbook" – Second edition / Mc Graw – Hill

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		3	0	0	3
AUTOMOTIVE HVAC (ELECTIVE – III)					

UNIT I
Refrigeration
Introduction - Methods of refrigeration ,Vapour compression refrigeration system - Vapour absorption refrigeration system, Commonly used refrigerants , Refrigerants used inautomobile air conditioning

UNIT II
Psychometry
Psychometric properties, tables, charts - Psychometric processes - Comfort charts – Factoraffecting comfort - Effective temperature - Ventilation requirements

UNIT III
Air Conditioning Systems and Load Analysis
Classification and layouts - Central / unitary air conditioning systems - Components like compressors, evaporators, condensers, expansion devices, fan blowers, heating systems etc.
Load Analysis: Outside & inside design consideration - Factors forming the load on refrigeration & air conditioning systems - Cooling & heating load calculations - Load calculations for automobiles - Effect of air conditioning load on engine performance.

UNIT IV
Air Distribution Systems
Distribution duct system, sizing, supply / return ducts - Types of grills, diffusers, ventilation, air noise level - Layout of duct systems for automobiles and their impact on load calculations.
Air Routine & Temperature Control: Objectives - evaporator care air flow - Through the dashre-circulating unit - Automatic temperature control - Controlling flow - Control of air handlingsystems.

UNIT V
Air Conditioning Service and Control
Air conditioner maintenance & service - servicing heater system - Removing & replacing components.
Air Conditioning Control: Common control such as thermostats- Humidity status - Control dampers - Pressure cutouts and relays

Text Books
1. Mark Schnubel, “Automotive Heating and Air Conditioning”, Today’s Technician, 5th edn,2013
2. C. P. Arora, Refrigeration & Air Conditioning

References
1. Steven Daly, “Automotive Air Conditioning and Climate Control Systems”, Butterworth - Heinemann; 1 edition (2006)
2. Norman C. Harris, “Modern Air-Conditioning Practice”, McGraw-Hill Education 1984
3. R.J. Dossat, “Principles of Refrigeration”, Prentice Hall, 5th ed, 2001.
4. Paul Lung, "Automotive Air Conditioning", C.B.S. Publisher & Distributor, (Delhi. 1991)

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		3	0	0	3
SPECIAL PURPOSE VEHICLES (ELECTIVE – III)					

COURSE OBJECTIVES:

i. To enhance the knowledge of the students about the various equipment's used in earth moving, applications.

ii. To understand the construction and working of the vehicle for constructional application

iii. To describe the working nature of farm equipment's based on their application.

iv. To discriminate the various industrial vehicles based on the purpose.

v. To acquire the knowledge on the functioning of military vehicle.

UNIT I
EARTH MOVING EQUIPMENTS

Construction layout, capacity and applications of dumpers, articulated haulers, front-end loaders, backhoe loaders, bulldozers, scrappers, motor graders, skid steer loaders ,excavator, hydraulic shovels, bucket conveyors , surface miners – highwall Miners. Selection criteria of prime mover for dumpers.

UNIT II
CONSTRUCTIONAL EQUIPMENTS

Construction layout, capacity and applications of cranes – types , Articulated Trucks ,concrete ready mixer, trenchers , Asphalt Pavers , road reclaimers , Compactors – types , draglines, drillers, borewell machine .

UNIT III
FARM EQUIPMEMTS

Classification of tractors – Main components of tractor. Working attachment of tractors – Auxiliary equipment –- Top lifting harvesters. General description, working, specification and functions paddy harvesting machines, Sugarcane harvesting, feller bunchers, forest machines.

UNIT IV
INDUSTRIAL VEHICLES

Constructional features, capacity and working of fork lifts, Utility vehicles, towing vehicles, man-lift chassis, scissor lift trucks, material handlers, reclaimers, Street sweepers.

UNIT V
MILITARY AND COMBAT VEHICLES

Special features and constructional details of Main Battle tank, gun carriers, transport vehicles, Armoured vehicle-launched bridge, amphibious bridging vehicle, communication vehicles.

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TEXT BOOKS:

1. Abrosimov. K. Bran berg.A. andKatayer.K., " Road making Machinery ", MIR Publishers, Moscow, 1971.
2. Rodichev and G.Rodicheva, Tractor and Automobiles, MIR Publishers, 1987.
3. Wong.J.T., " Theory of Ground vehicles ", John Wiley & Sons, New York, 1987.

REFERENCES:

1. B. Geleman and M. Moskovin, Farm tractors, MIR publishers, Moscow.
2. Bart H Vanderveen, Tanks and Transport vehicles, Frederic Warne and Co ltd., London.
3. Kolchin,A., and V.Demidov, Design of Automotive Engines for Tractor, MIR Publishers, 1972.
4. Peurifoy R.L “Construction Planning, Equipment and Methods”, Tata McGraw-Hill, New Delhi, 2002.
5. Wong J “ Terramechanics and Off-Road Vehicle Engineering”, Butterworth-Heinemann, 2009

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		0	0	12	8
PROJECT II					

Objectives:
The aim of the course is to make the student perform a comprehensive project work that involves either or all of the following: optimum design of a mechanical component or an assembly, thermal analysis, computer aided design & analysis, cost effective manufacturing process, material selection, testing procedures or fabrication of components and prepare a detailed technical thesis report. The completed task should also take into account the significance of real time applications, energy management and the environmental affects.

Outcomes:
After completing the project work the student should learn the technical procedure of planning, scheduling and realizing an engineering product and further acquire the skills of technical report writing and data collection.

Course content:
The student should work in groups to achieve the aforementioned objectives and the outcomes.