



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE102709

Course / Subject Name: Advance Combustion Technology

w. e. f. Academic Year:	2023-24
Semester:	7 th
Category of the Course:	Professional Elective - 6

Prerequisite:	NIL
Rationale:	The course aims to impart basic skills of force analysis, understanding of automobile systems, and design of automobile components.

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				(E)	(M)	(I)	(V)	
3	0	2	4	60	40	20	30	150

Course Content:

Unit	Content	Hours	% of Weightage
1	Gasoline direct injection engines: - Introduction, Overview of direct injection gasoline engines, Potential and technologies for high efficiency direct injection gasoline engine, High pressure fuel injection system, Exhaust emissions and after treatment devices.	08	20
2	Stratified charge engine: - Introduction, Thermodynamics and combustion process, Methods of charge stratification, Engines with stratified gasoline direct injection	07	10
3	Turbocharged direct injection spark ignition engine: - - Introduction, Historical background: turbocharging for high specific output, Problems and challenges associated with turbocharging spark ignition engines, Advantages of combining direct injection and turbocharging in spark ignition engines, Challenges of applying direct injection to a turbocharged spark ignition engine	08	30



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4	Direct injection natural gas engines: - Introduction, Building an engine, Fuel injection, Ignition, Combustion, Emission control	06	10
5	Multiple injection diesel combustion process: - Introduction, Double injection or pilot + main, Multiple injection technology, Factor affecting combustion in multiple injection, Multiple injections with the rate control, Multiple injections with late fuel injection.	08	20
6	Homogenous Charge Compression Ignition (HCCI) Engines: - Introduction, HCCI combustion fundamentals, Gasoline HCCI engine, Diesel HCCI combustion engines, operational limits and emissions	08	10
Total		45	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
-	-	-	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Compare gasoline direct injection technology with other gasoline injection technology based on technology potential, combustion process and exhaust emission.	Understand
2	Describe the thermodynamic aspects and combustion systems of stratified charge engine	Apply
3	Determine approaches to build a natural gas engine with controlled combustion.	Apply
4	Evaluate the effect of pilot, post- and multiple fuel injection strategies on engine combustion, performance and emissions.	Apply

CO-PO Mapping

PO/CO	CO1	CO2	CO3	CO4
PO-1 Basic Engg Knowledge	3	3	2	3



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PO-2 Problem Analysis	2	2	2	2
PO-3 Design/Development	2	2	3	3
PO-4 Investigations	1	2	3	3
PO-5 Modern Tool Usage	1	2	2	2
PO-6 Engineer & Society	0	0	0	0
PO-7 Environment & Sustainability	0	0	0	0
PO-8 Ethics	1	1	1	1
PO-9 Individual & Team Work	1	1	1	1
PO-10 Communication	1	1	1	1
PO-11 Project Management	1	1	1	1
PO-12 Lifelong Learning	1	1	1	1

CO-PSO Mapping

PSO	CO1	CO2	CO3	CO4
PSO1	3	3	3	3
PSO2	2	2	2	2



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PSO3	1	1	1	1
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References/Suggested Learning Resources:

Books:

1. Advanced direct injection combustion engine technologies and development, Vol. 1 by Hua Zhao
2. Advanced direct injection combustion engine technologies and development, Vol. 2 by Hua Zhao
3. Gasoline and gas engines by Hua Zhao
4. HCCI and CAI engines for the automotive industry by Hua Zhao

Open source software and website:

1. <http://nptel.ac.in>

Suggested Course Practical List:

1. Study combustion parameters of gasoline and diesel engine.
2. Study methods to measure combustion parameters of IC engine.
3. Identify different parts of gasoline direct injection system for any two/four wheeler engine and study working of it.
4. Study technological modification between MPFI engine and GDI (gasoline direct injection engine)

Suggested Equipment list:

1. Computational facility.
2. Noise and vibration measurement instruments

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SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE102710

Course / Subject Name: Automotive Aerodynamics and Aesthetics

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w. e. f. Academic Year:	2023-24
Semester:	7 th
Category of the Course:	NIL

Prerequisite:	Fluid Mechanics
Rationale:	At the end of the course, the students will be able to apply basic principles of aerodynamics for the design of vehicle body and importance of aesthetics.

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				(E)	(M)	(I)	(V)	
3	0	2	4	60	40	20	30	150

Course Content:

Unit	Content	Hours	% of Weightage
1	Introduction: - Introduction of air flow, boundary layer velocity profile, mechanics of air flow and pressure around a vehicle, flow separation, vehicle aerodynamic performance, characteristics of aerodynamic forces and moments, drag of a simple bodies plate, sphere and Streamline bodies, SAE aerodynamic axis system	08	10
2	Aerodynamic lift and drag:- Aerodynamic Drag: Pressure (form) drag, air resistance opposing the motion of a vehicle, after flow wake, drag coefficient, drag coefficient and various body shapes, base drag, vortices, trailing vortex drag, attached transverse vortices. lift coefficients, vehicle lift, underbody floor height versus aerodynamic lift and drag, aero foil lift and drag.	07	20
3	Aerodynamic drag reduction and lift control: - Profile edge rounding or chamfering, bonnet slop and windscreen rake, roof and side panel cambering, rear side panel taper, underbody rear end upward taper, rear end tail extension, underbody roughness.	06	20



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Course/Subject Code: BE102710

Course / Subject Name: Automotive Aerodynamics and Aesthetics

	Aerodynamic lift control: under body dams, exposed wheel air pattern, partial enclosed wheel air flow pattern, rear end spoiler, and negative lift air foil wings.		
4	Shape optimization of cars: - Front end modification, front and rear wind shield angle, boat ai ling, hatchback, fast back and square back, notch back drag, kamm-back, cabriolet cars. Dust Flow patterns at the rear, effects of gap configuration, effect of fasteners.	04	20
5	Commercial vehicle aerodynamics fundamental: - Principles of Commercial Vehicle Aerodynamics, effect of rounding sharp front cab body edges, effect of different cab to trailer body heights with both sharp and rounded upper windscreen leading edges, fore body pressure distribution, effect of a cab to trailer body roof height step. Commercial vehicle drag reducing devices: - cab roof deflectors, yaw angle, cab roof deflector effectiveness versus yaw angle, comparison of drag resistance with various commercial vehicle cab arrangement relative to trailer body height, corner vanes, cab to trailer Body gap, cab to trailer body gap seals, tractor and trailer skirting, comparison of various devices used to reduce vehicle drag, effect of trailer load position on a vehicle's drag resistance.	06	15
6	Aerodynamic testing:- Wind tunnel testing and measurement: Function, features and types of wind tunnels, types of wind tunnel test sections, divergent and convergent collector in wind tunnel, test sequence, measurement of flow velocity, measurement of flow direction, pressure measurements, measurements of aerodynamic loads using wind tunnel balances, measurement of the frontal area, flow visualization scale model testing, full scale testing in wind tunnel On-road testing and measurements: drag measurement using Coast down tests, cross wind tests, on-road cooling tests, soiling of windows and chassis parts, on-road measurements of the wind noise	07	15
7	Automobile aesthetics:- Definition, aerodynamic vehicle development process and importance of the aesthetic aspects, technical criteria for aesthetic design of exterior and interior, digital aesthetic design process, Body styling process: Product planning, package, concept sketching and package related sketching, full sized tape drawing, clay modeling	07	10
Total		45	100

Suggested Specification Table with Marks (Theory):



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Program Name: Engineering

Level: U.G

Course/Subject Code: BE102710

Course / Subject Name: Automotive Aerodynamics and Aesthetics

Distribution of Theory Marks

R Level	U Level	A Level	N Level	E Level	C Level
-	-	-	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Illustrate various flow phenomenon related to vehicles	Understand
2	Demonstrate and analyse different types of drag forces and provide exposure on drag/lift reduction enhancing vehicle performance	Apply
3	Optimize various shape configurations in automobiles	Apply
4	Illustrate the principle of wind tunnel technology	Apply

CO-PO Mapping

PO/CO	CO1	CO2	CO3	CO4
PO-1 Basic Engg Knowledge	3	3	3	2
PO-2 Problem Analysis	2	2	2	2
PO-3 Design/Development	2	2	3	3
PO-4 Investigations	1	2	3	3
PO-5 Modern Tool Usage	1	2	2	2
PO-6 Engineer & Society	0	0	0	0
PO-7 Environment &	0	0	0	0



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Level: U.G

Course/Subject Code: BE102710

Course / Subject Name: Automotive Aerodynamics and Aesthetics

Sustainability				
PO-8 Ethics	1	1	1	1
PO-9 Individual & Team Work	1	1	1	1
PO-10 Communication	1	1	1	1
PO-11 Project Management	1	1	1	1
PO-12 Lifelong Learning	1	1	1	1

CO-PSO Mapping

PSO	CO1	CO2	CO3	CO4
PSO1	3	3	3	2
PSO2	2	2	2	2
PSO3	1	1	1	1

References/Suggested Learning Resources:

Books:

1. Product Design and Development by AK Chitale and Gupta
2. Automotive Aerodynamic: Update SP-706 - SAE - 1987
3. Vehicle Aerodynamics - SP-1145 - SAE – 1996.
4. Hucho. W.H. - “Aerodynamic of Road Vehicles” - Butterworth’s Co., Ltd., - 1997
5. Pope, A, Wind Tunnel Testing, John Wiley & Sons, 2nd Edn., New York, 1994.
6. Low Speed Wind Tunnel Testing by J. B. Barlow, W. H. Rae, Jr, A. Pope.
7. Advanced Vehicle Technology by Heinz Heisler.
8. Race Car Vehicle Dynamics by Milliken and Milliken.



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9. Aerodynamics of Road Vehicles by Thomas Christian Schuetz.

Open source software and website:

1. <http://auto.howstuffworks.com/>
2. <https://www.carbibles.com/>
3. <https://www.youtube.com/>

Suggested Course Practical List:

1. Study terminologies related to vehicle aerodynamics and SAE vehicle aerodynamic axis.
2. Measure and study effect of vehicle aerodynamic on fuel economy and power consumption.
3. Prepare /study any vehicle scale model for wind tunnel testing using standard procedure.
4. Perform and study wind tunnel testing for simple bodies like plate, sphere, aerofoil to measure drag and lift.
5. Perform and study wind tunnel testing for pressure distribution and flow pattern around any small scale vehicle (car/bus) model.
6. Study the effect of different aerodynamic aids for reduction of vehicle drag and control of lift.
7. Study/Measure the drag reduction aids for any commercial vehicle/vehicle model.
8. Study drag measurement using road testing e.g. Coast down tests, crosswind tests, on-road cooling tests, soiling of windows and chassis parts, wind noise etc.
9. Identify various technical criteria for aesthetic exterior and interior design.
10. Study body styling process and digital aesthetic design process.

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SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE102702

Course / Subject Name: Automotive Component and system Design

w. e. f. Academic Year:	2025-26
Semester:	7 th
Category of the Course:	Professional Core

Prerequisite:	Nil
Rationale:	The course aims to impart basic skills of force analysis, understanding of automobile systems, and design of automobile components.

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				(E)	(M)	(I)	(V)	
3	0	2	4	60	40	20	30	150

Course Content:

Unit	Content	Hours	% of Weightage
1	Design Considerations: Standardization, Preferred numbers, Tolerances and Fits, Ergonomics, System design, Manufacturing considerations.	02	11
2	Bearing Selection: Rolling Contact Bearing: Types of rolling contact bearings, static and dynamic load capacities, Stribeck's Equation, Equivalent bearing load, load life relationship, Bearing life, Load factor, Selection of bearings from manufacturers catalogue. Lubrication and mountings, dismounting and preloading of bearings, Oil seals and packing.	04	23
	Gears: Types of gears, Design consideration of gears, material selection, Types of gear failures, Gear lubrication. Spur Gears: Force analysis, Number of teeth, Face width & Beam strength of gear tooth. Dynamic tooth load. Effective load on gear tooth. Estimation		



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Program Name: Engineering

Level: U.G

Course/Subject Code: BE102702

Course / Subject Name: Automotive Component and system Design

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3	of module based on beam strength. Wear strength of gear tooth. Estimation of module based on wears strength. Spur gear design for maximum power transmission. Helical Gears: Virtual number of teeth, Tooth proportions, Force analysis, Beam strength of helical gears, Effective load on gear tooth, Wear strength of helical gears, Design of helical gears Bevel Gears: Terminology of bevel gears, Force analysis, Beam strength of bevel gears, Wear strength of bevel gear, Effective load on gear tooth, Design of bevel gear.	09	20
4	Transmission Drive: Manual gearboxes, Manual gearbox classification, Mechanical efficiency, Manual automobile gearboxes, Manual gearboxes for industrial vehicle, Gear shifting mechanisms, Synchronizers, Differential drives, Automatic gear boxes	09	17
5	Design of I.C. Engine Components : Design of piston assembly, Design and selection of cylinders, Valve gear mechanism design.	08	20
6	Automotive System : Wheels and tyres, Suspension system, Steering Systems, Braking System, Control System, Chassis Structure	15	09
	Total	42	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
-	-	-	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Relate various standard used in industry and utilize knowledge of manufacturing process in design of machine elements.	Apply
2	Determine forces acting on automobile components like gears, bearings, piston assembly, cylinders and perform stress analysis for automobile components.	Apply
3	Inspect manual and automatic automobile gear boxes and gear shifting	Apply



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Program Name: Engineering

Level: U.G

Course/Subject Code: BE102702

Course / Subject Name: Automotive Component and system Design

	mechanisms.	
4	Dissect and examine automobile systems.	Apply

CO-PO Mapping

PO/CO	CO1	CO2	CO3	CO4
PO-1 Basic Engg Knowledge	3	3	2	2
PO-2 Problem Analysis	2	2	2	2
PO-3 Design/Development	2	2	3	3
PO-4 Investigations	1	2	3	3
PO-5 Modern Tool Usage	1	2	2	2
PO-6 Engineer & Society	0	0	0	0
PO-7 Environment & Sustainability	0	0	0	0
PO-8 Ethics	1	1	1	1
PO-9 Individual & Team Work	1	1	1	1
PO-10 Communication	1	1	1	1
PO-11 Project Management	1	1	1	1
PO-12 Lifelong Learning	1	1	1	1



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Level: U.G

Course/Subject Code: BE102702

Course / Subject Name: Automotive Component and system Design

CO-PSO Mapping

PSO	CO1	CO2	CO3	CO4
PSO1	3	3	3	2
PSO2	2	2	2	2
PSO3	1	1	1	1

References/Suggested Learning Resources:

Books:

1. Design of Machine Elements, V B Bhandari, 3/e, Tata McGraw Hill.
2. A Textbook of Machine Design, P C Sharma and D K Aggarwal, S K Kataria & sons.
3. Shigley's Mechanical Engineering Design, R G Budnyas, J K Nisbett, McGraw Hill.
4. Machine Design: An Integrated Approach, R L Norton, Pearson
5. Machine Tool Design and Numerical Control, N K Mehta, Tata McGraw Hill Edu.
6. Design Data, Faculty of Mechanical Engineering, PSG College of Engineering, Coimbatore.
7. Automotive Chassis, Vol. I : Components Design, G Genta, L Morello, Springer
8. An Introduction to Modern Vehicle Design, Julian Happian Smith, Butterworth Heine Mann
9. Automotive Transmissions : Fundamentals, Selection, Design and Application, H Naunheimer, B Bertsche, J Ryborz, W Novak, Springer

Open source software and website:

1. <http://nptel.ac.in>

Suggested Course Practical List:

1. Design of gears and selection of bearings for automobiles.
2. Design of IC engine components for automobiles.
3. Analysis of transmission drives.
4. Study and analysis of automobile systems like braking system, suspension system, steering systems.



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Program Name: Engineering

Level: U.G

Course/Subject Code: BE102702

Course / Subject Name: Automotive Component and system Design

Suggested Equipment list:

1. Computational facility.

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SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE102708

Course / Subject Name: Automotive Noise Vibration and Harshness

w. e. f. Academic Year:	2023-24
Semester:	7 th
Category of the Course:	Professional Elective - 5

Prerequisite:	Fluid Mechanics
Rationale:	The course aims to impart basic skills of force analysis, understanding of automobile systems, and design of automobile components.

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				(E)	(M)	(I)	(V)	
3	0	2	4	60	40	20	30	150

Course Content:

Unit	Content	Hours	% of Weightage
1	Fundamentals of Noise and 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	10	20
2	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.	11	20



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Level: U.G

Course/Subject Code: BE102708

Course / Subject Name: Automotive Noise Vibration and Harshness

3	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, Sound Level Meters, Noise Dosimeters, Equipment for Data Acquisition, Noise and Vibration Measurements , Determination of Sound Power Level and Emission Sound Pressure Level, Sound Intensity Measurements, Signal Processing in Time and Frequency Domain, Digitalisation of Signals, Signal-to-Noise Ratio, Sampling as a Mapping, Nyquist-Shannon Sampling Theorem, Antialiasing Filter, Sound and Vibration Measuring Chain, Signal Analysis Based on Fourier Transform, Time and Frequency Domain, Fourier Series for Periodic Functions, Fourier Transform of the Continuous-Time Functions, Noise and Vibration Data Analysis	12	30
4	Transportation Noise and Vibration—Sources, Prediction Introduction to Transportation Noise and Vibration Sources , Internal Combustion Engine Noise Prediction and Control—Diesel and Gasoline Engines , Exhaust and Intake Noise and Acoustical Design of Mufflers and Silencers , Tire/Road Noise, Aerodynamic Sound Sources in Vehicles, Transmission and Gearbox Noise and Vibration Prediction, Brake Noise , Introduction to Interior Transportation Noise and Vibration Sources, Automobile, Bus, and Truck Interior Noise and Vibration Prediction	12	30
Total		43	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
-	-	-	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Summarize basics of noise and vibration.	Understand
2	Interpret the effect of noise, blast, vibration and shock on human beings.	Apply
3	Examine and analyse the sources of noise and vibration in vehicles.	Apply



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Program Name: Engineering

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Course/Subject Code: BE102708

Course / Subject Name: Automotive Noise Vibration and Harshness

4	Measure and interpret noise and vibration generated from different sources.	Apply
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CO-PO Mapping

PO/CO	CO1	CO2	CO3	CO4
PO-1 Basic Engg Knowledge	3	3	2	2
PO-2 Problem Analysis	2	2	2	2
PO-3 Design/Development	2	2	3	2
PO-4 Investigations	1	2	3	2
PO-5 Modern Tool Usage	1	2	2	2
PO-6 Engineer & Society	0	0	0	0
PO-7 Environment & Sustainability	0	0	0	0
PO-8 Ethics	1	1	1	1
PO-9 Individual & Team Work	1	1	1	1
PO-10 Communication	1	1	1	1
PO-11 Project Management	0	0	0	0
PO-12 Lifelong Learning	1	1	1	1



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Program Name: Engineering

Level: U.G

Course/Subject Code: BE102708

Course / Subject Name: Automotive Noise Vibration and Harshness

CO-PSO Mapping

PSO	CO1	CO2	CO3	CO4
PSO1	3	3	3	2
PSO2	2	2	2	2
PSO3	1	1	1	1

References/Suggested Learning Resources:

Books:

1. Handbook of Noise and Vibration Control, Malcolm J Crocker, Wiley
2. Engineering Noise Control: Theory and Practice, David A.Bies and Colin H.Hansen, Spon Press.
3. Harris' Shock and Vibration Handbook, Allan G. Piersol, Thomas L. Paez, McGraw-Hill.
4. Vehicle Noise and Vibration Refinement, Xu Wang, CRC press.

Open source software and website:

1. <http://nptel.ac.in>

Suggested Course Practical List:

1. Study of noise and vibration measuring instruments
2. Experiments related to noise and vibration signal acquisition and analysis.
3. Experiments for vibration and noise source predictions,
4. Experiments related to signal processing of noise and vibration data from different sources.

Suggested Equipment list:

1. Computational facility.
2. Noise and vibration measurement instruments



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE102707

Course / Subject Name: Automotive Pollution and Control

w. e. f. Academic Year:	2023-24
Semester:	7 th
Category of the Course:	Professional Elective - 5

Prerequisite:	Fluid Mechanics
Rationale:	The main objective of this course is to impart knowledge in automotive pollution control. The detailed concept of formation and control techniques of pollutants like UBHC, CO, NO _x , particulate matter and smoke for both SI and CI engine will be taught to the students. The instruments for measurement of pollutants and emission standards will also be introduced to the students. At the end of the course the students will have command over automotive pollution and control.

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				(E)	(M)	(I)	(V)	
3	0	2	4	60	40	20	30	150

Course Content:

Unit	Content	Hours	% of Weightage
1	EMISSION FROM AUTOMOBILES - Pollutants – sources – formation – effects of pollution on environment – human – transient operational , effects on pollution – Regulated – Unregulated emissions - Emission Standards.	08	20
2	EMISSION FROM SPARK IGNITION ENGINE AND ITS CONTROL Emission formation in SI Engines – Carbon monoxide & Carbon di oxide – Unburned hydrocarbon, NO _x , PM – Effects of design and operating variables on emission formation – controlling of pollutants – fuel modifications - Positive Crank case ventilation system, Evaporative Emission Control, Exhaust Gas Recirculation, Secondary air injection, thermal reactor, Catalytic converters – Types – substrate, Wash coat and Catalyst, Cold start emission control – Close coupled catalytic converter,	10	20



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Level: U.G

Course/Subject Code: BE102707

Course / Subject Name: Automotive Pollution and Control

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	Hydrocarbon Adsorber- Lean de-NOx Catalysts- NOx traps – Catalyst deactivation, use of unleaded petrol		
3	EMISSION FROM COMPRESSION IGNITION ENGINE AND ITS CONTROL Formation of White, Blue, and Black Smokes, Soot, Particulate Matter NOx, SOx, HC, CO and Intermediate Compounds – Significance Effect of design and Operating variables on Emission formation —Fuel modification/additives, CRDI - High Injection Pressure and Injection Rate Shaping and Multiple injection, EGR- EGR Cooling and Heating, EGR Control, Fumigation, Diesel Oxidation Catalysts, Diesel de-NOx Catalysts, NOx traps, SCR, Diesel Particulate Filters - DPF material, structure and regeneration- HCCI Engines	10	20
4	NOISE POLLUTION FROM AUTOMOBILES Sources of Noise — Engine Noise, Transmission Noise, vehicle structural Noise, aerodynamicsnoise, Exhaust Noise. Noise reduction in Automobiles — Encapsulation technique for noise reduction — Silencer Design	06	20
5	TEST PROCEDURES AND EMISSION MEASUREMENTS Test cycles for light and medium duty vehicles – US-EPA cycle, ECE and EUDC cycle, Japanese cycle, Indian driving cycles – steady state and transient cycles - SHED Test - Chassis dynamometer – Constant Volume Sampling (CVS) Procedure for driving cycles - Emission analyzers — NDIR, FID, Chemilumin esecent Analyzer (CLA), Smoke meters, Gas Chromatography, Particulate Emission Measurement - Dilution Tunnel, Sound level meters	09	20
	Total	43	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
-	-	-	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Understand the mechanism of formation of various emissions in IC engines	Understand



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Program Name: Engineering

Level: U.G

Course/Subject Code: BE102707

Course / Subject Name: Automotive Pollution and Control

2	Understand the effects of pollution on human health and environment.	Apply
3	Understand the emission control techniques	Apply
4	Develop fundamentals of the emission norms and test procedures	Apply

CO-PO Mapping

PO/CO	CO1	CO2	CO3	CO4
PO-1 Basic Engg Knowledge	3	3	2	2
PO-2 Problem Analysis	2	2	2	2
PO-3 Design/Development	2	2	3	2
PO-4 Investigations	1	2	3	2
PO-5 Modern Tool Usage	1	2	2	2
PO-6 Engineer & Society	0	0	0	0
PO-7 Environment & Sustainability	0	0	0	0
PO-8 Ethics	1	1	1	1
PO-9 Individual & Team Work	1	1	1	1
PO-10 Communication	1	1	1	1
PO-11 Project Management	0	0	0	0



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE102707

Course / Subject Name: Automotive Pollution and Control

PO-12 Lifelong Learning	1	1	1	1
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CO-PSO Mapping

PSO	CO1	CO2	CO3	CO4
PSO1	3	3	3	2
PSO2	2	2	2	2
PSO3	1	1	1	1

References/Suggested Learning Resources:

Books:

1. Bernard Challen and Rodica Baranescu, "Diesel Engine Reference Book" – Second edition – SAEInternational Publications– 1999.
2. D.J.Patterson and N.A.Henin, 'Emission from Combustion Engine and their control', Anna ArborScience Publication,1985
3. B.P. Pundir, "Engine Emissions - Pollutant Formation and Advances in Control Technology" Narosa Publishing house Pvt. Ltd, 2011
4. Geoff Davies, "Materials for Automobile Bodies", Butterworth-Heinemann, 2012.
5. Paul Degobert, "Automobiles and Pollution" SAE Publications, 1991
6. Ganesan, V., "Internal Combustion Engines", Tata McGraw Hill Co., 1994.
7. Ramalingam. K.K., "Internal Combustion Engines", Scitech Publications, 2003
8. Springer and Patterson, "Engine Emission", Plenum Press, 1990

Open source software and website:

1. <http://nptel.ac.in/>
2. <http://npti.in/default.aspx>

Suggested Course Practical List:

1. Study of Emission Standards for Automobile.
2. Measure CO, HC emission from petrol engines on exhaust gas analysis



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE102707

Course / Subject Name: Automotive Pollution and Control

3. Measure diesel exhaust smoke of diesel engine on diesel smoke meter
4. Demonstrate Exhaust gas re-circulation (EGR) system
5. Service of Catalytic converter
6. To study Noise reduction techniques in Automobiles.
7. Study of various Emission Analyzers

Suggested Equipment list:

1. Multi-meter
2. Electric scooter
3. Lithium-ion battery
4. Lead acid battery
5. BLDC motor, induction motor, permanent magnet motor
6. Cut section of BLDC motor, induction motor, permanent magnet motor
7. Mechanic tool kit

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SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE102706

Course / Subject Name: Electric and Hybrid Vehicles

w. e. f. Academic Year:	2023-24
Semester:	7 th
Category of the Course:	Professional Elective - 5

Prerequisite:	Nil
Rationale:	This course goes deeper into the various aspects of hybrid and electric drive train such as their configuration, types of electric machines that can be used, energy storage devices, etc. Each topic will be developed in logical progression with up-to-date information.

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				(E)	(M)	(I)	(V)	
3	0	2	4	60	40	20	30	150

Course Content:

Unit	Content	Hours	% of Weightage
1	Introduction: History of electric, hybrid and fuel cell vehicles, environmental and social importance of fuel cell, electric and hybrid vehicles. Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis. Fuel cell Drive-trains: Basic concept of fuel cell vehicle, introduction to fuel cell drive-train topologies.	06	20
2	Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Hybridization of different energy storage devices.	09	20



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE102706

Course / Subject Name: Electric and Hybrid Vehicles

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	Batteries: Lead-acid battery, Nickel-based batteries, Metal/air batteries Sodium-βbatteries, lithium batteries, Evaluation of batteries, Battery parameters and measurement Introduction and working of ultra-capacitor and high-speed flywheels.		
3	Electric Propulsion: Introduction to electric motors, power electronics and control strategies used in electric propulsion, Configuration and control of DC and BLDC Motordrives, Configuration and control of Induction Motor drives, Configuration and control of permanent magnet motor and switched reluctance motors. Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor and energy storage.	09	20
4	Fuel cell Technology: fuel cell characteristics, alkaline fuel cell, proton exchange membrane fuel cell, direct methanol fuel cell, phosphoric acid fuel cell, molten carbonate fuel cell, solid oxide fuel cell, fuel cell model, hydrogen storage systems	08	15
5	EV Auxiliaries: Battery characteristics and chargers, battery indication and management, temperature control units, power steering units, auxiliary power supplies, regenerative braking systems	06	15
6	Communications, supporting subsystems: In vehicle networks- CAN, Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies	07	10
	Total	45	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
-	-	-	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Illustrate various Architectures related to Hybrid Drive train, electric drive train and fuel cell vehicle Choose proper energy storage systems for vehicle applications	Understand
2	Design and choose electric propulsion for vehicle.	Apply



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE102706

Course / Subject Name: Electric and Hybrid Vehicles

3	Describe different types of Fuel cells, its operation, and performance	Apply
4	Identify various communication protocols and technologies used in vehicle networks.	Apply

CO-PO Mapping

PO/CO	CO1	CO2	CO3	CO4
PO-1 Basic Engg Knowledge	3	3	2	2
PO-2 Problem Analysis	2	2	2	2
PO-3 Design/Development	2	2	3	3
PO-4 Investigations	1	2	3	3
PO-5 Modern Tool Usage	1	2	2	2
PO-6 Engineer & Society	0	0	0	0
PO-7 Environment & Sustainability	0	0	0	0
PO-8 Ethics	1	1	1	1
PO-9 Individual & Team Work	1	1	1	1
PO-10 Communication	1	1	1	1
PO-11 Project Management	1	1	1	1
PO-12 Lifelong Learning	1	1	1	1



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE102706

Course / Subject Name: Electric and Hybrid Vehicles

CO-PSO Mapping

PSO	CO1	CO2	CO3	CO4
PSO1	3	3	3	2
PSO2	2	2	2	2
PSO3	1	1	1	1

References/Suggested Learning Resources:

Books:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2011
2. C.C. Chan and K.T. Chau, Modern Electric Vehicle Technology, Oxford University Press, 2001
3. James Larminie, "Electric Vehicle Technology Explained", John Wiley & Sons, 2003.
4. Fuel Cell Handbook by EG &G Technical Services, Inc. Seventh Edition
5. Ali Emadi, Mehrdad Ehsani, John M. Muller, "Vehicular Electric Power Systems", Marcel Dekker, Inc., 2004.
6. Chris Mi, M. Abul Masrur, David Wenzhong Gao, Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives, John Wiley & Sons Ltd., 2011
7. Hoogers, G., Edr. "Fuel Cell Technology Handbook", CRC Press, Washington D. C., 2003
8. Larminie, J. and Dicks, A., "Fuel Cell Systems Explained" John Wiley & Sons, Ltd., New York, 2001.

Open source software and website:

1. <http://nptel.ac.in/>
2. <http://npti.in/default.aspx>
3. <https://www.youtube.com/>

Suggested Course Practical List:

1. Study of wiring layout of electric vehicle.
2. Study of various topologies of hybrid vehicle.
3. Study of Batteries used for electric vehicles.



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE102706

Course / Subject Name: Electric and Hybrid Vehicles

4. Study of electric propulsion system.
5. Study of Battery parameters and Testing of batteries for electric vehicle.
6. Study of fuel cells and their characteristics.
7. Dismantling, Assembling and study of electric scooter.

Suggested Equipment list:

1. Multi-meter
2. Electric scooter
3. Lithium-ion battery
4. Lead acid battery
5. BLDC motor, induction motor, permanent magnet motor
6. Cut section of BLDC motor, induction motor, permanent magnet motor
7. Mechanic tool kit

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SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE101705

Course / Subject Name: Finite Element Methods

w. e. f. Academic Year:	2023-24
Semester:	7 th
Category of the Course:	Professional Elective - 6

Prerequisite:	NIL
Rationale:	The course aims to impart basic skills of formulation and application of finite element methods for the analysis of mechanical systems.

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				(E)	(M)	(I)	(V)	
3	0	2	4	60	40	20	30	150

Course Content:

Unit	Content	Hours	% of Weightage
1	Fundamental Concepts Introduction, Stresses and Equilibrium, Boundary Conditions, Strain—Displacement Relations, Stress—Strain Relations, Temperature Effects, Potential Energy and Equilibrium: The Rayleigh—Ritz Method, Potential Energy, Rayleigh—Ritz Method, Galerkin's Method, Saint Venant's Principle, Von Mises Stress, Principle of Superposition, Matrix Algebra and Gaussian Elimination, Conjugate Gradient Method for Equation Solving, Conjugate Gradient Algorithm.	5	20
2	One-Dimensional Problems Introduction, Finite Element Modeling, Element Division, Numbering Scheme, Shape Functions and Local Coordinates, The Potential-Energy Approach, Element Stiffness Matrix, Force Terms, The Galerkin Approach, Element Stiffness, Force Terms, Assembly of the Global Stiffness Matrix and Load Vector, Properties of K, The Finite Element Equations: Treatment of Boundary Conditions, Types of Boundary Conditions, Elimination Approach, Penalty Approach, Multipoint Constraints, Quadratic Shape Functions Temperature	9	10



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE101705

Course / Subject Name: Finite Element Methods

	Effects, Problem Modeling and Boundary Conditions, Problem in Equilibrium, Symmetry, Two Elements with Same End Displacements, Problem with a Closing Gap		
3	Trusses Introduction, Plane Trusses, Local and Global Coordinate Systems, Formulas for Calculating I and m, Element Stiffness Matrix, Stress Calculations, Temperature Effects, Three-Dimensional Trusses, Assembly of Global Stiffness Matrix for the Banded and Skyline Solutions, Assembly for Banded Solution, Skyline Assembly, Problem Modeling and Boundary Conditions, Inclined Support in Two Dimensions, Inclined Support in Three Dimensions–Line Constraint, Inclined Support in Three Dimensions–Plane Constraint, Symmetry and Antisymmetry	9	30
4	Beams and Frames Introduction, Potential-Energy Approach, Galerkin Approach, Finite Element Formulation, Element Stiffness–Direct Approach, Load Vector, Boundary Considerations, Shear Force and Bending Moment, Beams on Elastic Supports, Plane Frames, Three-Dimensional Frames, Problem Modeling and Boundary Conditions	6	10
5	Two-Dimensional Problems using Constant Strain Triangles Introduction, Finite Element Modeling, Constant Strain Triangle (CST), Isoparametric Representation, Potential-Energy Approach, Element Stiffness, Force Terms, Integration Formula on a Triangle, Galerkin Approach, Stress Calculations, Temperature Effects, Problem Modeling and Boundary Conditions, Some General Comments on Dividing into Elements, Patch Test and Convergence, Patch Test, Orthotropic Materials, Temperature Effects.	8	20
6	Axisymmetric Solids Subjected to Axisymmetric Loading Introduction, Axisymmetric Formulation, Finite Element Modeling: Triangular Element, Potential-Energy Approach, Body Force Term, Rotating Flywheel, Surface Traction, Galerkin Approach, Stress Calculations, Temperature Effects, Problem Modeling and Boundary Conditions, Cylinder Subjected to Internal Pressure, Infinite Cylinder, Belleville Spring, Thermal Stress Problem	7	10
	Total	45	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
-	-	-	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE101705

Course / Subject Name: Finite Element Methods

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Demonstrate the concepts of finite element methods and its application in the field of mechanical engineering.	Understand
2	Analyze one dimensional and two dimensional systems using finite element methods	Apply
3	Make use of finite element methods for analysis of trusses, beams, frames and axisymmetric solids.	Apply
4	Estimate thermal stresses of machine elements.	Apply

CO-PO Mapping

PO/CO	CO1	CO2	CO3	CO4
PO-1 Basic Engg Knowledge	3	3	3	2
PO-2 Problem Analysis	2	2	2	2
PO-3 Design/Development	2	2	3	3
PO-4 Investigations	1	2	3	3
PO-5 Modern Tool Usage	1	2	2	2
PO-6 Engineer & Society	0	0	0	0
PO-7 Environment & Sustainability	0	0	0	0
PO-8 Ethics	1	1	1	1
PO-9 Individual & Team Work	1	1	1	1



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE101705

Course / Subject Name: Finite Element Methods

PO-10 Communication	1	1	1	1
PO-11 Project Management	1	1	1	1
PO-12 Lifelong Learning	1	1	1	1

CO-PSO Mapping

PSO	CO1	CO2	CO3	CO4
PSO1	3	3	3	2
PSO2	2	2	2	2
PSO3	1	1	1	1

References/Suggested Learning Resources:

Books:

1. Introduction to Finite Elements in Engineering, Chandrupatla T. R. and Belegunda A. D., PHI.
2. A First Course in Finite Elements, Jacob Fish, Ted Belytschko, John Wiley & Sons Ltd
3. An Introduction to Finite Element Method, J N Reddy, McGraw - Hill.
4. Concepts and Applications of Finite Element Analysis, R D Cook, Wiley India.

Open source software and website:

1. <http://nptel.ac.in>

Suggested Course Practical List:

1. Introduction to Finite Element Analysis software.
2. Solve 1D – Structural, thermal and fluid problems using FEA software and manually.
3. Solve Plane truss problems, using FEA software and manually. Include problems with symmetry.
4. Solve Beam problems with different boundary and loading conditions using FEA software and manually.
5. Solve planar problems.



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE101705

Course / Subject Name: Finite Element Methods

6. Solve axis symmetric problems.

Suggested Equipment list:

1. Computational facility and FAE solvers.

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SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE102703

Course / Subject Name: **Motor Vehicle Dynamics**

w. e. f. Academic Year:	2023-24
Semester:	7 th
Category of the Course:	Professional Elective - 4

Prerequisite:	Nil
Rationale:	To understand the principle and performance of vehicle in various modes such as longitudinal, vertical and lateral directions. At the end of the course the student will be able to identify the various forces and loads and performance under acceleration, ride and braking.

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				(E)	(M)	(I)	(V)	
3	0	2	4	60	40	20	30	150

Course Content:

Unit	Content	Hours	% of Weightage
1	Understanding Vehicle dynamics: History, Fundamental Approach to Modeling (Lumped mass, Vehicle Fixed Coordinate system, Earth Fixed Coordinate System, Euler Angles). Acceleration performance of Vehicle Power-limited Acceleration (based on Engines, Power Train – transmission & final drive ratio, Automatic Transmissions). Traction-limited Acceleration (Transverse weight shift due to drive torque, traction limits). Braking Performance Basic Equations (Constant Deceleration, deceleration with wind resistance), Energy / Power absorbed during braking, Braking Forces, Brakes factor, Tire road Friction, Federal Requirements for Braking Performance, Braking Proportioning, Anti-Lock brake system, Braking Efficiency,	06	10



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SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE102703

Course / Subject Name: **Motor Vehicle Dynamics**

	Rear wheel Lockup, Pedal Force Gain.		
2	Aerodynamics: Mechanics of Air Flow Around a Vehicle, Pressure Distribution on a Vehicle, Aerodynamic Forces, Drag Components, Aerodynamics Aids. Rolling Resistance (Factors affecting rolling resistance, Typical coefficient), Total road Loads and effect of Road loads on Fuel economy.	04	20
3	Tire Mechanics: Tire Construction, Size and Load Rating, Terminology and Axis System, Tractive Properties, Cornering Properties, Camber Thrust, Aligning Moment, Combined Braking and Cornering, Conicity and Ply Steer, Slip, Skid, Rolling Resistance, Elastic Band Model for longitudinal slip, Simple model for lateral slip, Combined longitudinal/lateral slip (friction ellipse), Taut string model for lateral slip, Magic Tire Formula.	07	20
4	Suspensions: Suspension Kinematics, Suspension types, Solid Axles, Independent Suspensions, Anti-Squat and Anti-Pitch Suspension Geometry, Anti-Dive Suspension Geometry, Roll Center Analysis, Suspension Dynamics, Multi-body vibration, Body and Wheel hop modes, Invariant points, Controllable Suspension Elements: Active, Semi- Active. Choice of suspension spring rate, Calculation of effective spring rate, Vehicle suspension in fore and aft directions.	08	10
5	The Steering System: The Steering Linkages, Steering System Forces and Moments, Steering System Models, Steering Geometry, Steady Handling (2 DOF steady state model), Under steer and Over steer, Effect of Tire Camber and Vehicle Roll (3 DOF steady-state model), Transient Handling and Directional Stability (2 DOF unsteady model), Effect of Vehicle Roll on Transient Handling (3 DOF unsteady model), Steady-State and Transient Handling of Articulated Vehicles.	08	15
6	Rollover: Quasi-Static Rollover of a Rigid Vehicle, Quasi-Static Rollover of a Suspended Vehicle, Transient Rollover, Steady-state Cornering Basics, Low-speed Turning, High-speed cornering (Tire Cornering forces, Cornering Equations).	04	10
7	Motorcycle Dynamics: Kinematic structure of motorcycle, geometry of motorcycles, importance of trail, Resistance forces acting on motorcycle (tyre rolling resistance, aerodynamic resistance forces, resistant force caused by slope), Location & height of motor cycle's centre of gravity (C.G), Moments of inertia on Motorcycle. Introduction to Front & Rear suspensions of Motorcycle.	05	15
	Total	42	100



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE102703

Course / Subject Name: **Motor Vehicle Dynamics**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
-	-	-	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Demonstrate a skill to apply basic theories to establish useful models for either the entire vehicle or components of the vehicle.	Understand
2	Interpret the properties of critical factors in vehicle motion control and apply the models established from basic theories for vehicle design and improvement	Apply
3	Identify key components and their working principles of modern vehicles also identify the technology improvements in vehicles in the last several decades.	Apply
4	Relate the course materials to daily driving experience of a vehicle, in particular those related to driving safety	Apply

CO-PO Mapping

PO/CO	CO1	CO2	CO3	CO4
PO-1 Basic Engg Knowledge	3	3	2	2
PO-2 Problem Analysis	2	2	2	2
PO-3 Design/Development	2	2	3	3
PO-4 Investigations	1	2	3	3
PO-5 Modern Tool Usage	1	2	2	2



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE102703

Course / Subject Name: **Motor Vehicle Dynamics**

PO-6 Engineer & Society	0	0	0	0
PO-7 Environment & Sustainability	0	0	0	0
PO-8 Ethics	1	1	1	1
PO-9 Individual & Team Work	1	1	1	1
PO-10 Communication	1	1	1	1
PO-11 Project Management	1	1	1	1
PO-12 Lifelong Learning	1	1	1	1

CO-PSO Mapping

PSO	CO1	CO2	CO3	CO4
PSO1	3	3	3	2
PSO2	2	2	2	2
PSO3	1	1	1	1

References/Suggested Learning Resources:

Books:

1. Hans Pacejka, Tire and Vehicle Dynamics, Elsevier, 2012.
2. Thomas D Gillespie, "Fundamentals of Vehicle dynamics", SAE USA 1992.
3. Rajesh Rajamani, Vehicle Dynamics & control, Springer.



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE102703

Course / Subject Name: **Motor Vehicle Dynamics**

4. R.V. Dukkupati, Vehicle dynamics, Narsova Publications.
5. Wong J Y, "Theory of Ground Vehicles", John Wiley & Sons, New York, 1978.
6. Milliken W F and Milliken D L, Race car Vehicle Dynamics, SAE.
7. Garrett T K, Newton K and Steeds W, "Motor Vehicle", Butter Worths & Co., Publishers Ltd., New Delhi, 2001.
8. R N Jazar, Vehicle Dynamics: Theory and Application, Springer.

Open source software and website:

1. <http://nptel.ac.in/courses/107106080/>

Suggested Course Practical List:

1. Experimental study of mechanism for air flow over different geometry of vehicles.
2. Experimental studies of measurements of drag and lift coefficient for different geometry vehicle using wind tunnel apparatus.
3. To study the effect of tire pressure and temperature on the performance of the tyre.
4. To simulate and study a quarter car models using MBD (Multi Body Dynamics) software.
5. To simulate and understand behavior of sprung / un-sprung mass & lumped mass system MBD software.
6. Finding the stiffness of tire with variation of air pressure.
7. To simulate and study the effect of different conditions on vehicle loading.
8. Study of latest technologies available nowadays in vehicles helping to maintain stability of the vehicle on the road.
9. Study geometry of motorcycles as well as various types of forces faced by the motorcycle & its rider
10. Study the location & height of Centre of gravity (C.G) of a motorcycle

Suggested Equipment list:

1. Wind tunnel apparatus
2. Multibody (MBD) simulation software

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SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE101712

Course / Subject Name: Nanotechnology and surface Engineering

w. e. f. Academic Year:	2023-24
Semester:	7 th
Category of the Course:	Professional Elective - 3

Prerequisite:	NIL
Rationale:	To make students understand the use of concept of nanotechnology and nano science in the industries and in consumer products. The surface properties must be modified for aesthetics, oxidation resistance, hardness, wear resistance, fatigue resistance or other considerations. This course will be useful for the student to develop essential skill & knowledge of the surface coating technologies in demand.

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				(E)	(M)	(I)	(V)	
3	0	0	3	60	40	0	0	100

Course Content:

Unit	Content	Hours	% of Weightage
1	Basic Elements of Nano-science and Nanotechnology: Engineering scale of nanotechnology, different classes of nano-materials, synthesis of nano-materials, fabrication and characterization of nanostructures, Engineering applications- Cosmetics and Consumer Goods, Nano Sensor, Nano catalysts, Water Treatment and the Environment, Paints, Food and Agriculture Industry.	12	20
2	Nanotechnology and Ceramics : Introduction, Vapor Condensation Methods, Sputtering, Laser Method, Spray Pyrolysis, Thermo Chemical /Flame Decomposition of metal organic Precursors methods	8	10
3	Tools to characterize Nanomaterials:	6	20



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE101712

Course / Subject Name: Nanotechnology and surface Engineering

	X-Ray Diffraction (XRD), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic Force Microscopy, UV/Visible Spectroscopy		
4	Surface Engineering: Introduction to surface engineering, Scope of surface engineering for different engineering materials, Surface Preparation methods such as Chemical, Electrochemical, Mechanical: Sand Blasting, Shot peening, Shot blasting, Hydro-blasting, Vapor Phase Degreasing etc., Coatings: Classification, Properties and applications of Various Coatings.	6	20
5	Different methods for surface modifications: Surface modification by use of directed energy beams, Plasma, Sputtering & Ion Implantation. Surface modification by Friction stir processing. Surface composites.	10	20
6	Case studies based on coatings and surface modification of important engineering components.	5	10
	Total	47	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
-	-	-	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	To comprehend basics of nano-science and technology and their applications in the domain of engineering.	Apply
2	To impart fundamental knowledge of various methods used in the field of nano-technology	Apply
3	To impart basics of various characterization tools/methods in the field of Nano-Technology.	Apply
4	Explain the effect of process parameters on the properties & microstructure of the surface coating processes.	Apply

CO-PO Mapping



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE101712

Course / Subject Name: Nanotechnology and surface Engineering

PO/CO	CO1	CO2	CO3	CO4
PO-1 Basic Engg Knowledge	3	3	3	2
PO-2 Problem Analysis	2	2	2	2
PO-3 Design/Development	2	2	3	3
PO-4 Investigations	1	2	3	3
PO-5 Modern Tool Usage	1	2	2	2
PO-6 Engineer & Society	0	0	0	0
PO-7 Environment & Sustainability	0	0	0	0
PO-8 Ethics	1	1	1	1
PO-9 Individual & Team Work	1	1	1	1
PO-10 Communication	1	1	1	1
PO-11 Project Management	1	1	1	1
PO-12 Lifelong Learning	1	1	1	1

CO-PSO Mapping



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE101712

Course / Subject Name: Nanotechnology and surface Engineering

PSO	CO1	CO2	CO3	CO4
PSO1	3	3	3	2
PSO2	2	2	2	2
PSO3	1	1	1	1

References/Suggested Learning Resources:

Books:

1. Nanostructures and Nanomaterials: Synthesis, Properties and Applications by G. Cao, Imperial College Press, 2004.
2. Nanoscale Science and technology by Robert Kelsall (editor), Ian W. Hamley (co-editor), Mark Geoghegan (co-editor), ISBN: 978-0-470-85086-2
3. The Chemistry of Nanomaterials: Synthesis, Properties and Applications by C. N. R. Rao, A. Muller, A. K. Cheetham, WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, ISBN: 3-527-30686-2.
4. Nanoscale Materials in Chemistry Edited by Kenneth J. Klabunde, John Wiley & Sons, Inc., ISBNs: 0-471-38395-3 (Hardback); 0-471-22062-0.
5. Textbook of Nanoscience and Nanotechnology, B.S. Muty, P. Shankar, Baldev Raj, B.B Rath and James Murday, University Press, IIM (ISBN-978 81 7371 738 3).
6. Introduction to Nanotechnology by Charles P. Poole Jr and Frank J. Owens, Wiley-Inter science, 2003.
7. James A. Murphy- Surface Preparation and Finishes for Metal, McGraw-Hill, New York 1971
8. Surface Engineering Hand Book, edited by Keith Austin, London : Kogan Page, 1998

Open source software and website:

1. <https://nptel.ac.in/course.php>

Suggested Course Practical List:

1. Introduction to Finite Element Analysis software.
2. Solve 1D – Structural, thermal and fluid problems using FEA software and manually.
3. Solve Plane truss problems, using FEA software and manually. Include problems with symmetry.
4. Solve Beam problems with different boundary and loading conditions using FEA software and manually.
5. Solve planar problems.
6. Solve axis symmetric problems.

Suggested Equipment list:



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE101712

Course / Subject Name: Nanotechnology and surface Engineering

1. Electronics Microscope, XRD, UV

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SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE102704

Course / Subject Name: Product Lifecycle Management

w. e. f. Academic Year:	2023-24
Semester:	7 th
Category of the Course:	NIL

Prerequisite:	Basic knowledge of vehicle garage practice
Rationale:	Product lifecycle Management is an essential tool for coping with the challenges of more demanding global competition and ever-shortening product and component lifecycles and growing customer needs. New, better and more flexible products must be introduced into markets more quickly, with more profit and less labor, and the lifecycle of each product must be better controlled. In order to perform well financially, companies must be able to make informed decisions concerning the lifecycle of each product in their portfolio. To do this well, the subject is designed for students to understand each aspect of product and lifecycle of product.

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				(E)	(M)	(I)	(V)	
3	0	2	4	60	40	20	30	150

Course Content:

Unit	Content	Hours	% of Weightage
1	Fundamental of Product Life Cycle Management(PLM): Definition, Product Life cycle model, Threads of PLM, Need for PLM, Opportunities and Benefits of PLM, Views, Components and Phases of PLM, PLM feasibility study, PLM visioning.	06	10
2	PLM Concepts, Processes and Workflow: Characteristics of PLM, Environment driving PLM, PLM Elements, Drivers of PLM, Conceptualization, Design, Development, Validation, Production, Support of PLM.	06	10



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE102704

Course / Subject Name: Product Lifecycle Management

3	Product Data Management (PDM) Process and Workflow: PDM systems and importance, reason for implementing a PDM system, financial justification of PDM implementation. Versioning, check-in and checkout, views, Metadata, Lifecycle, and workflow. Applied problems and solution on PDM processes and workflow.	06	20
4	Collaborative Product Development: Engineering vaulting, product reuse, smart parts, engineering change management, Bill of materials and process consistency, Digital mock-up and prototype development, design for environment, virtual testing and validation, marketing collateral.	06	20
5	Tools of Communication for collaborative work: Creation of 3DXML and CAD drawing using CAD software. Creation of an animation for assembly instructions on 3D via composer, creation of an acrobat 3D document. Applied Problems and solutions on tools of communication for collaborative work.	06	15
6	Knowledge and optimization of design products: Know how, best practices, parameterization of design, Applied problems and Solution on optimization of products using power copy, publication, parameters, formula, rule, check, Design table, configuration, reaction.	06	10
7	Digital Manufacturing-PLM: Digital manufacturing, benefits manufacturing, manufacturing the first-one, Ramp up, virtual learning curve, manufacturing the rest, production is planning.	04	10
8	Developing a PLM strategy and conducting a PLM assessment: Strategy, Impact of strategy, implementing PLM strategy, PLM initiatives to support corporate objectives. Infrastructure assessment, assessment of current systems and applications.	05	5
Total		45	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
-	-	-	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

Course Outcome:

After Completion of the Course, Student will able to:



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE102704

Course / Subject Name: Product Lifecycle Management

No	Course Outcomes	RBT level
1	Describe Product Life cycle management concept, processes and workflow	Understand
2	Explain the various strategies of PLM and Product Data Management and work flow	Apply
3	Describe collaborative product development and tools .	Apply
4	Demonstrate knowledge and optimization of design product	Apply

CO-PO Mapping

PO/CO	CO1	CO2	CO3	CO4
PO-1 Basic Engg Knowledge	3	3	3	2
PO-2 Problem Analysis	2	2	2	2
PO-3 Design/Development	2	2	3	3
PO-4 Investigations	1	2	3	3
PO-5 Modern Tool Usage	1	2	2	2
PO-6 Engineer & Society	0	0	0	0
PO-7 Environment & Sustainability	0	0	0	0
PO-8 Ethics	1	1	1	1
PO-9 Individual & Team Work	1	1	1	1
PO-10 Communication	1	1	1	1



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE102704

Course / Subject Name: Product Lifecycle Management

PO-11 Project Management	1	1	1	1
PO-12 Lifelong Learning	1	1	1	1

CO-PSO Mapping

PSO	CO1	CO2	CO3	CO4
PSO1	3	3	3	2
PSO2	2	2	2	2
PSO3	1	1	1	1

References/Suggested Learning Resources:

Books:

1. Antti Saaksvuori, Anselmie Immonen, Product Life Cycle Management Springer,
2. Product Lifecycle Management, Michael Grieves, Tata McGraw Hill
3. Product Life Cycle Management/ John Stark/ Springer –Verlag/ UK
4. Product Lifecycle Management/ Michael Grives/ McGraw Hill

Open source software and website:

1. <http://auto.howstuffworks.com/>
2. <https://www.carbibles.com/>
3. <https://www.youtube.com/>

Suggested Course Practical List:

1. Product concept development process
2. Product design and development process for different common industry products
3. Life cycle analysis of product
4. Product data management process and workflow
5. Collaborative product development process and different tools
6. Product optimization



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE102704

Course / Subject Name: Product Lifecycle Management

7. Demonstration of digital manufacturing
8. Product lifecycle management and assessments

Suggested Equipment list:

1. Hydraulic hoist
2. Electronic tyre inflator
3. Tyre changer
4. Wheel aligner
5. Wheel balancer
6. Petrol injector cleaner test setup
7. Diesel nozzle tester and cleaner setup
8. Measuring and gauging instruments

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Swaminarayan University

Teaching & Examination Scheme
Course – Faculty of Engineering (Degree)
Branch – Automobile Engineering
Semester – 7th

Subject Code	Subject Name	Category	L	T	P	Total Credit	E	M	I	V	Total Marks
BE100701	Summer Internship	Project	0	0	0	2	00	00	20	80	100
BE102701	Measurement, Instrumentation and Control in Automobile	Professional Core	3	0	0	3	60	40	00	00	100
BE102702	Automotive Component and system Design	Professional Core	3	0	2	4	60	40	20	30	150
BE102703	Motor Vehicle Dynamics	Professional Elective - 4	3	0	2	4	60	40	20	30	150
BE102704	Product Lifecycle Management		3	0	2	4	60	40	20	30	150
BE102705	Vehicle and Road Safety		3	0	2	4	60	40	20	30	150
BE102706	Electric and Hybrid Vehicles	Professional Elective - 5	3	0	2	4	60	40	20	30	150
BE102707	Automotive Pollution and Control		3	0	2	4	60	40	20	30	150
BE102708	Automotive Noise Vibration and Harshness		3	0	2	4	60	40	20	30	150
BE102709	Advance Combustion Technology	Professional Elective - 6	3	0	2	4	60	40	20	30	150
BE102710	Automotive Aerodynamics and Aesthetics		3	0	2	4	60	40	20	30	150
BE101705	Finite Element Methods		3	0	2	4	60	40	20	30	150
BE101712	Nanotechnology and surface Engineering	Open Elective - 3	3	0	0	3	60	40	0	0	100
BE105712	Fundamentals of Internet of Things		3	0	0	3	60	40	0	0	100
	Total		18	0	8	24					

L=Lecture, T=tutorial, P=Practical, E=Theory External, M=Theory Internal, I=Practical Internal, V=Practical External



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE102705

Course / Subject Name: Vehicle and Road Safety

w. e. f. Academic Year:	2023-24
Semester:	7 th
Category of the Course:	Professional Elective - 4

Prerequisite:	Nil
Rationale:	Subject is designed to cover various and concerned over utilizing appropriate safety procedures with maintenance & service of vehicles and generate awareness about road accidents, traffic rules and characteristics of accident, people's responsibilities and duties for road safety, imparting knowledge about importance of multidisciplinary approach to planning for traffic safety and rehabilitation.

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				(E)	(M)	(I)	(V)	
3	0	2	4	60	40	20	30	150

Course Content:

Unit	Content	Hours	% of Weightage
1	The Concept of Vehicle Safety: Need of safety, active safety: driving safety, conditional safety; perceptibility safety, operating safety- passive safety, exterior safety, interior safety, deformation behavior of vehicle body.	12	10
2	Vehicle Safety System: Regulations, automatic seat belt Tightener system; Collapsible steering column; Tilttable steering wheel. Electronic system for activating air bags; Bumper design for safety; antiskid braking system.	12	20



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE102705

Course / Subject Name: Vehicle and Road Safety

3	Speed Control Devices: Causes of rear end collision; Frontal object detection; Rear vehicle object detection system; Object detection system with braking system interactions.	06	10
4	Introduction to Road Safety: Road traffic accidents scenario in India and in world. Road Safety and its importance. Traffic rules and driving behaviour. characteristics of accidents, accidents vs. crash, crash test	03	10
5	Planning for Road Safety: Awareness about rules and regulations of traffic, assisting traffic control authorities. Multidisciplinary approach to planning for traffic safety and injury control, Vulnerable road users: crashes related to pedestrian and bicyclists, their safety, provision for disabled.	04	15
6	Responsibility of Road Accidents and Safety Measures: People responsible for accident prevention: Police, Politicians, Community members, Policy makers, Teachers, Parents, Infrastructure authorities, Drivers and Official road safety body. Reasons of students/ children have accidents. 4 E's of Accidents Prevention: 1.Engineering – by altering the environment 2. Enforcement - by imposing laws 3. Encouragement - by the use of publicity campaigns 4. Education - by gaining and using knowledge	03	10
7	Road Safety Education: Introduction to Road Safety Education. 5 P's of Road safety education: 1. Pre-school road safety education 2. Practical rather than theory education 3. Principles of own development as regards to road safety education 4. Presentations on road safety education 5. Place for road safety education in syllabus	02	15
8	Road Safety Events: Discussions on efforts done by Government on Road Safety. Celebration of Road Safety week or Workshop on Road Safety week/ Organization of seminar on Road Safety. This is to be entirely organized by students under the mentorship of concerned Head of the Department.	02	10
Total		44	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
-	-	-	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

Course Outcome:



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE102705

Course / Subject Name: Vehicle and Road Safety

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Summarize Importance of vehicular safety and demonstrate Safety considerations in automobile	Understand
2	Generate awareness about road accidents, characteristics of accident and traffic rules.	Apply
3	Gain information and knowledge about people responsible for accidents and their duties	Apply
4	Understand the importance of multidisciplinary approach to planning for traffic safety habitation and dramatize road safety events	Apply

CO-PO Mapping

PO/CO	CO1	CO2	CO3	CO4
PO-1 Basic Engg Knowledge	3	3	3	2
PO-2 Problem Analysis	2	2	2	2
PO-3 Design/Development	2	2	3	2
PO-4 Investigations	1	2	3	2
PO-5 Modern Tool Usage	1	2	2	2
PO-6 Engineer & Society	0	0	0	0
PO-7 Environment & Sustainability	0	0	0	0
PO-8 Ethics	1	1	1	1
PO-9 Individual & Team Work	1	1	1	1



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE102705

Course / Subject Name: Vehicle and Road Safety

PO-10 Communication	1	1	1	1
PO-11 Project Management	1	1	1	1
PO-12 Lifelong Learning	1	1	1	1

CO-PSO Mapping

PSO	CO1	CO2	CO3	CO4
PSO1	3	3	3	2
PSO2	2	2	2	2
PSO3	1	1	1	1

References/Suggested Learning Resources:

Books:

1. Ronald. K. Jurgen-“Automotive Electronics Handbook” -Second edition-McGraw-HillInc., 1999.
2. ARAI Safety standards.
3. Kadiyali L.R., Traffic Engineering & Transport Planning, Khanna Publishers, 2003
4. Indian Roads Congress, Highway Safety Code, IRC: SP-44:1996
5. Indian Roads Congress, Road Safety Audit Manual, IRC: SP-88-2010

Open source software and website:

1. <https://nptel.ac.in/courses/107/106/107106088/>
2. <https://nptel.ac.in/courses/105/105/105105204/>
3. <https://irsc.road-safety.co.in/home/>



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE102705

Course / Subject Name: Vehicle and Road Safety

Suggested Course Practical List:

1. Study of Bumper design for safety
2. Study of advanced automobile seat belts and Air bag systems.
3. Study of advanced steering wheel and steering system.
4. Study anti-skid braking system and antilock brake system.
5. Study rear vehicle object detection system.
6. Study of central door locking systems
7. Study of characteristics of accidents.
8. Study of Multidisciplinary approach to planning for traffic safety and injury control
9. Study of Accidents prevention and people's responsibility for accident prevention.
10. Study of 5 P's of Road safety education.

Suggested Equipment list:

1. Cut section of Automobile

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SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE102602

Course / Subject Name: Vehicle Service book

सर्व विद्या अधिपतये

w. e. f. Academic Year:	2023-24
Semester:	7 th
Category of the Course:	Fundamental

Prerequisite:	Basic knowledge of vehicle garage practice
Rationale:	NIL

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				(E)	(M)	(I)	(V)	
3	0	2	4	60	40	20	30	150

Course Content:

Unit	Content	Hours	% of Weightage
1	Maintenance Basics: Need for maintenance, types of maintenance: preventive and breakdown maintenance, requirements of maintenance, safety precautions in maintenance: General safety, tool safety.	02	10
2	Tools, Equipment and Instruments: Study and application of hand tools, power tools, Special purpose tools, measuring and gauging instruments. Study of Service/Repair equipment with operating process.	05	10
3	Workshop management practices: Types, functions, operations and activities of service stations. Layouts of modern service station/workshop. Study of workshop documents & records like Inspection schedule, job cards, parts catalogue, parts price list, vehicle history sheet, warranty card, bill & billing procedure of vehicle, logbook of vehicle, customer satisfaction sheet, service book, etc. Activities and responsibilities of workshop management. Study of workflow in service station.	06	20



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE102602

Course / Subject Name: Vehicle Service book

	Customer complaint Handling & consumer cases in case of any dispute.		
4	Maintenance & Overhauling of engine: Engine disassembly, dismantling of engine components: cylinder head, valve train, cylinder block, connecting rod, piston and crankshaft assembly; cleaning and inspection of engine components, reconditioning of components. Engine assembling process. Diagnosis causes and remedies of Engine related problems. Fuel, Lubrication and Cooling Systems: Servicing and maintenance of fuel system, Engine tune-up, cooling system: water pump, radiator, and thermostat. Lubrication system maintenance, Anticorrosion and anti-freeze additives	08	20
5	Maintenance & Overhauling of Transmission Systems: Servicing and maintenance of clutch, gear box, universal joints, propeller shaft, differential and final drive. Diagnosis, causes and remedies of transmission related problems. Maintenance & Overhauling of Braking System: Maintenance of hydraulic brakes; brake adjustments and bleeding of brakes. Maintenance of air brake.	06	15
6	Maintenance & Overhauling of Steering, Suspension and Wheels and tyre: Maintenance of steering system. Lubrication and maintenance of suspension system. Maintenance of wheel and tyre. Tyre rotation, Wheel balancing and Wheel Alignment, Diagnosis, causes and remedies of steering system, wheels and suspension related problems.	06	10
7	Maintenance of Electrical Systems: Servicing and maintenance of battery, starter motor, alternator, ignition system, lighting system, electric horn, and wiper motor	06	10
8	Maintenance & repair of vehicle body: Maintenance of vehicle body; minor and major repairs. Body repair tools & equipment. Introduction to denting & painting process of vehicles.	06	5
	Total	45	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
-	-	-	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

Course Outcome:



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE102602

Course / Subject Name: Vehicle Service book

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Understand the importance of vehicle inspection, Maintenance and application of tools.	Understand
2	Diagnose the causes of Engine problem and provide the remedial action Identify the causes and service and maintain the clutch, gear box, universal joints, propeller shaft, differential and braking system.	Apply
3	Possess the knowledge about the inspection and maintenance of suspension, steering system and wheels and tyre.	Apply
4	Apply the basic knowledge and rectify the electrical systems problems and maintain vehicle body	Apply

CO-PO Mapping

PO/CO	CO1	CO2	CO3	CO4
PO-1 Basic Engg Knowledge	3	3	2	2
PO-2 Problem Analysis	2	2	2	2
PO-3 Design/Development	1	2	3	2
PO-4 Investigations	1	2	2	3
PO-5 Modern Tool Usage	1	2	2	2
PO-6 Engineer & Society	0	0	0	0
PO-7 Environment & Sustainability	0	0	0	0
PO-8 Ethics	1	1	1	1
PO-9 Individual & Team Work	1	1	1	1



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE102602

Course / Subject Name: Vehicle Service book

PO-10 Communication	1	1	1	1
PO-11 Project Management	1	1	1	1
PO-12 Lifelong Learning	1	1	1	1

CO-PSO Mapping

PSO	CO1	CO2	CO3	CO4
PSO1	3	3	2	2
PSO2	2	2	2	2
PSO3	1	1	1	1

References/Suggested Learning Resources:

Books:

1. Automotive Mechanics by William H. Crouse & Donald L. Anglin; Tata McGrawHill Publishing Company Ltd.
2. Automobile systems by Anil Chikara, Satya Prakashan.
3. Automobile Engineering by K.K.Ramlingan, SciTech Publication.
4. Auto mechanics by Joseph Heitner, East West Press.
5. Automotive Service Basics by Pattern and Donald, Pearson Publications
6. Vehicle Service book
7. Vehicle Workshop Manual.
8. Parts Price List
9. Parts catalogue of service station.
10. Job cards of modern service station.

Open source software and website:

1. <http://auto.howstuffworks.com/>



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: U.G

Course/Subject Code: BE102602

Course / Subject Name: Vehicle Service book

2. <https://www.carbibles.com/>

3. <https://www.youtube.com/>

Suggested Course Practical List:

1. Study of modern workshop layout
2. Study of different types of job cards & maintenance schedule chart
3. Study of measuring, gauging & service equipment
4. Performance on wheel balancer
5. Performance on wheel aligner
6. Cleaning and testing of petrol injector
7. Cleaning and testing of different types of nozzles
8. Bleeding of hydraulic brakes
9. Overhauling of any component or system of a vehicle
10. Study of different workshop documents & records

Suggested Equipment list:

1. Hydraulic hoist
2. Electronic tyre inflator
3. Tyre changer
4. Wheel aligner
5. Wheel balancer
6. Petrol injector cleaner test setup
7. Diesel nozzle tester and cleaner setup
8. Measuring and gauging instruments

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