K.L.N. COLLEGE OF ENGINEERING

Pottapalayam – 630 612, Sivagangai District

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Estd: 1994

FINAL YEAR CURRICULUM AND SYLLABUS

REGULATIONS 2020

For Under Graduate Program

B.E. AUTOMOBILE ENGINEERING

CHOICE BASED CREDIT SYSTEM

(For the students admitted from the academic year 2020-2021onwards)

K.L.N. COLLEGE OF ENGINEERING, POTTAPALAYAM
(An Autonomous Institution, Affiliated to Anna University, Chennai)

VISION OF THE INSTITUTION

To become a Centre of Excellence in Technical Education and Research in producing Competent and Ethical professionals to the society.

MISSION OF THE INSTITUTION

To impart Value and Need based curriculum to the students with enriched skill development in the field of Engineering, Technology, Management and Entrepreneurship and to nurture their character with social concern and to pursue their career in the areas of Research and Industry.

VISION OF THE DEPARTMENT

To be an Academic Centre for Quality Education, Innovation and Constructive Resources for the Automotive Industry and Society.

MISSION OF THE DEPARTMENT

To offer State-of-the-art Undergraduate Programme in Automobile Discipline to fulfill Industrial Requirements Globally by Imparting Innovative Knowledge, Ethical values and Collaborative Projects.

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PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1 Will have applied their engineering skills in solving contemporary issues of analyzing, designing and evaluating automobile engineering problems.

PEO2 Will have engaged in solving technical and social problems with their creative skills, interdisciplinary and collaborative approach with good communication skills.

PEO3 Will have ethically practiced their profession with leadership qualities to tackle business challenges.

PEO4 Will have involved in sustained learning to adapt themselves in continuously changing and challenging environment through self and professional studies.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1 Apply mathematics, science, and computing techniques in a comprehensive method to solve automobile engineering problems in the areas of Vehicle design, Vehicle dynamics, automotive electronics and Power train problems.

PSO 2 Use modern modeling and simulation techniques with acquired cross-discipline knowledge and industrial engineering concepts to develop strategies for solving automobile engineering problems in the current work environment.

PSO 3 Assess society needs and develop constructive and creative solutions for complexautomobile engineering problems under social and ethical constraints.

PO1: Engineering Knowledge

Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis

Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/Development of Solutions

Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems

Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage

Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The Engineer and Society

Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and Sustainability

Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics

Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Team Work

Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication

Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance

Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-Long Learning

Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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REGULATIONS 2020

For Under Graduate Program

B.E. AUTOMOBILE ENGINEERING

CHOICE BASED CREDIT SYSTEM

CATEGORY OF COURSES

i. **Humanities and Social Sciences (HS) Courses** include Technical English, Environmental Science and Engineering, Engineering Ethics and human values, Communication Skills and Management courses.

ii. **Basic Sciences (BS) Courses** include Mathematics, Physics, and Chemistry.

iii. **Engineering Sciences (ES) Courses** include Engineering Practices, Engineering Graphics, Basics of Electrical / Electronics / Mechanical / Computer Engineering / Instrumentation etc.

iv. **Professional Core (PC) Courses** include the core courses relevant to the chosen programme of study.

v. **Professional Elective (PE) Courses** include the elective courses relevant to the chosen programme of study.

vi. **Open Elective (OE) Courses** include courses from other departments which a student can choose from the list specified in the curriculum of the students B.E. / B.Tech. Programmes.

vii. **Employability Enhancement Courses (EEC)** include Project Work and/or Internship, Seminar, Professional Practices, Case Study and Industrial/Practical Training.

viii. **Mandatory Courses (MC)** include Personality and Character development and the courses recommended by the regulatory bodies such as AICTE, UGC, etc.

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REGULATIONS 2020

CHOICE BASED CREDIT SYSTEM

B.E. – AUTOMOBILE ENGINEERING

CURRICULAM AND SYLLABUS VII & VIII SEMESTERS

SEMESTER VII

. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	20AE701	Intelligent Vehicle Technology	PC	3	3	0	0	3
2	20AE702	Vehicle Dynamics	PC	3	3	0	0	3
3		Open Elective - II	OE	3	3	0	0	3
4		Professional Elective - II	PE	3	3	0	0	3
5		Professional Elective - III	PE	3	3	0	0	3
PRACTICAL								
6	20AE7L1	Engine Testing Lab	PC	4	0	0	4	2
7	20AE7L2	Vehicle Trouble Shooting Lab	PC	4	0	0	4	2
TOTAL				**23**	**15**	**0**	**8**	**19**

SEMESTER VIII

S. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	20AE801	Vehicle Body Engineering	PC	3	3	0	0	3
2		Professional Elective - IV	PE	3	3	0	0	3
PRACTICAL								
3	20AE8L1	PROJECT WORK	EEC	20	0	0	20	10
TOTAL				**26**	**6**	**0**	**20**	**16**

PROFESSIONAL ELECTIVE - II
SEMESTER VII

S. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20AE7A1	Automotive Heating Ventilation and Air-conditioning	PE	3	3	0	0	3
2.	20AE7A2	Off Road Vehicles	PE	3	3	0	0	3
3.	20AE7A3	Noise, Vibration and Harness	PE	3	3	0	0	3
4.	20AE7A4	Engine and Vehicle Management System	PE	3	3	0	0	3
5.	20AE7A5	Vehicle Maintenance	PE	3	3	0	0	3
6.	20AE7A6	Alternative Fuels and Energy Systems	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE - III
SEMESTER VII

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20AE7B1	Lean Methods For Automobile Engineers	PE	3	3	0	0	3
2	20HS6A1	Intellectual Property Rights	PE	3	3	0	0	3
3.	20HS7A2	Total Quality Management	PE	3	3	0	0	3
4.	20HS601	Operations Research	PE	3	3	0	0	3
5	20HS6A2	Entrepreneurship Development	PE	3	3	0	0	3
6	20HS602	Principles of Management	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE - IV
SEMESTER VIII

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	20AE8A1	Transport Management	PE	3	3	0	0	3
2	20AE8A2	Automotive Safety	PE	3	3	0	0	3
3.	20AE8A3	Automotive Pollution and Control	PE	3	3	0	0	3
4.	20AE8A4	Automotive Testing	PE	3	3	0	0	3
5.	20AE8A5	Regulatory Mechanism for Transportation Systems	PE	3	3	0	0	3
6	20ME7A2	Computer Integrated Manufacturing Systems	PE	3	3	0	0	3

OPEN ELECTIVE - II

SEMESTER VII

Courses offered by Other Departments for Department of Automobile Engineering

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	20OE105	Solar Photovoltaic Fundamentals and Applications	OE	3	3	0	0	3
2	20OE106	Fundamentals of Product Design	OE	3	3	0	0	3
3	20OE108	Industrial Safety Practices	OE	3	3	0	0	3
4	20OE205	Industrial Energy Auditing and Management	OE	3	3	0	0	3
5	20OE208	Electrical Drives and Control for Automation	OE	3	3	0	0	3
6	20OE405	Fundamentals of Machine Learning	OE	3	3	0	0	3
7	20OE406	Java Scripting	OE	3	3	0	0	3
8	20OE505	Essentials of Information Security	OE	3	3	0	0	3
9	20OE706	Industrial computer Networks	OE	3	3	0	0	3
10	20OE708	Instrumentation for Agro food industry	OE	3	3	0	0	3

OPEN ELECTIVE II (OE II) Courses offered to Other Departments

SEMESTER VII

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	20OE605	Lean Manufacturing Practices	OE	3	3	0	0	3
2	20OE606	Modern Vehicle Technology	OE	3	3	0	0	3
3	20OE607	New Generation Hybrid Vehicles	OE	3	3	0	0	3
4	20OE608	Automotive Electrical and Electronics Systems	OE	3	3	0	0	3

20AE701	INTELLIGENT VEHICLE TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES

- To acquire knowledge on intelligent systems, focusing on those in-vehicle solutions specifically designed to improve driving and travelling energy efficiency.
- To appreciate the role of electronics in providing improved control to a variety of vehicle systems.
- To enable evaluation of appropriate methodologies and be aware of the design and implementation issues of advanced techniques.

PREREQUISITE:

Course Code: 20AE501
Course Name: Automotive Electrical and Electronics

UNIT - I INTRODUCTION TO INTELLIGENT VEHICLE SYSTEMS 9

Definition, modern trends in Auto industry, various intelligent systems present in the vehicle, Need for IVS, Benefits, Advanced Driver Assistance System-Types/Levels, Next Generation Intelligent Vehicles, General Vehicle Control.

UNIT – II IOT IN AUTOMOBILES 9

Developments on IoT in Automotive Sector, Connected Car Services and Applications- Infotainment, Vehicle and Smartphone Integration, Driving Insights- Analytics, On Board Diagnostics, Real Time Driver Monitor, Geo fencing and Speed Monitoring, Stolen Vehicle Tracking, Biometrics Information for Driver Identification, Vehicle Communication- V2V, V2X, V2R, IoT in Intelligent Transportation Introduction to Autonomous Vehicle.

UNIT – III TRAFFIC SURROUNDINGS 9

Global Positioning Systems, Geographical Information Systems, Navigation Systems, Automotive Vision System, Road Recognition, Driver Assistance Systems - Connected Vehicles, Autonomous Vehicles.

UNIT – IV CONNECTED VEHICLE SYSTEMS 9

Introduction to CVS, Telematics control system architecture -driver information systems, Vehicle - vehicle interaction using TCS, Current trends in auto industry, In-Vehicle Entertainment System – Mirror link, Web link, App link, Apple Car Play, Android Auto. Application: ecall system - design, functions and limitations.

UNIT - V AUTONOMOUS VEHICLE COMFORT SYSTEMS AND APPLICATIONS 9

Driver safety systems- ABS, Driver Aid system- ESP, Blind Spot monitoring system, Collision mitigation system, Adaptive Headlamps, Automatic parking system, Eight way seating system, Adaptive cruise control system, Collapsible and tiltable steering column, Lane Departure Warning.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. A. Perallos, U. Hernandez-jayo, E. Onieva and I. Garcia-Zuazola (Eds.), Intelligent Transport Systems: Technologies and Applications, Wiley publications, 2015.
2. A. Eskandarian (Ed.), Handbook of Intelligent Vehicles, Springer-Verlag London Ltd, 2012.
3. R. K. Jurgen, Navigation and Intelligent Transportation Systems - Progress in Technology, Automotive Electronics Series, Warrendale, PA: SAE International, 2014.

REFERENCES:

1. H. Cheng, Autonomous Intelligent Vehicles: Theory, Algorithms, and Implementation, Berlin: Springer, 2011.
2. P. C. Cacciabue (Ed.), Modelling Driver Behavior in Automotive Environments: Critical Issues in Driver Interactions with Intelligent Transport Systems, Springer-Verlag London Ltd,
3. LjuboVlacic, Michel Parent and Fumio Harashima, Intelligent Vehicle Technologies, utterworth-Heinemann publications, Oxford, 2001.

OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : INTELLIGENT VEHICLE TECHNOLOGY		Course Code : 20AE701			
CO	Course Outcomes	Unit	K-CO	POs	PSOs
CO 1	Describe the importance of modern trends in vehicle System.	1	K2	1,2,3,10	-
CO 2	Apply the knowledge for selection of sensor and communication protocols for interfacing sensors.	2	K3	1,2,3,10	-
CO 3	Apply the knowledge for understanding the traffic information in the surroundings.	3	K3	1,2,3,10	-
CO 4	Compare the various intelligent systems used in automobiles.	4	K2	1,2,3,10	-
CO 5	Explain the entertainment features inside the vehicle.	5	K2	1,2,3,10	-
CO 6	Explain the intelligent systems associated with Autonomous vehicle.	5	K2	1,2,3,10	-

CO – PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	3	-	-	-	-	-	-	2	-	-	-	-	-
CO 2	3	3	3	-	-	-	-	-	-	2	-	-	-	-	-
CO 3	3	3	3	-	-	-	-	-	-	2	-	-	-	-	-
CO 4	3	3	3	-	-	-	-	-	-	2	-	-	-	-	-
CO 5	3	3	3	-	-	-	-	-	-	2	-	-	-	-	-
CO 6	3	3	3	-	-	-	-	-	-	2	-	-	-	-	-

20AE702	VEHICLE DYNAMICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know about the application of basic mechanics principles for dynamic analysis of vehicles.
- To analyze road vehicles for their vertical dynamic response to analyze ride, pitch and roll.
- To apply the concept of Longitudinal Dynamics and Lateral Dynamics related to vehicle handling, vehicle control and vehicle stability.

PRE-REQUISITE:
Course Code: 20AE401
Course Name: Mechanics of Machines

UNIT-I CONCEPT OF VIBRATION 9

Definitions, Modeling and Simulation, Global and Vehicle Coordinate System, Free, Forced, Un damped and Damped Vibration, Response Analysis of Single DOF, Two DOF, Multi DOF, Magnification factor, Transmissibility, Vibration absorber, Vibration measuring instruments, Torsional vibration, Critical speed.

UNIT-II TIRES 9

Tire forces and moments, Tire structure, Longitudinal and Lateral force at various slip angles, rolling resistance, Tractive and cornering property of tire. Performance of tire on wet surface. Ride property of tires. Magic formulae tire model, Estimation of tire road friction. Test on Various road surfaces. Tire vibration.

UNIT - III VERTICAL DYNAMICS 9

Human response to vibration, Sources of Vibration. Design and analysis of Passive, Semi-active and Active suspension using Quarter car, half car and full car model. Influence of suspension stiffness, suspension damping, and tire stiffness. Control law for LQR, H-Infinite, Skyhook damping. Air suspension system and their properties.

UNIT – IV LONGITUDINAL DYNAMICS AND CONTROL 9

Aerodynamic forces and moments. Equation of motion. Tire forces, rolling resistance, Load distribution for three wheeler and four wheeler. Calculation of Maximum acceleration, Reaction forces for Different drives. Braking and Driving torque. Prediction of Vehicle performance. ABS, stability control, Traction control.

UNIT – V LATERAL DYNAMICS 9

Steady state handling characteristics. Steady state response to steering input. Testing of handling characteristics. Transient response characteristics, Direction control of vehicles. Roll center, Roll axis, Vehicle under side forces. Stability of vehicle on banked road, during turn. Effect of suspension on cornering.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Singiresu S. Rao, "Mechanical Vibrations", 5th Edition, Prentice Hall, 2010
2. Wong. J. Y., "Theory of Ground Vehicles", 3rd Edition, Wiley-Interscience, 2001
3. Rajesh Rajamani, "Vehicle Dynamics and Control", 1st edition, Springer, 2005

REFERENCES:

1. Dean Karnopp, "Vehicle Stability", 1st edition, Marcel Dekker, 2004
2. Nakhaie Jazar. G., "Vehicle Dynamics: Theory and Application", 1st edition, Springer, 2008
3. Jan Zuijdijk, 'Vehicle dynamics and damping", Author House, 2009

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : VEHICLE DYNAMICS													Course Code : 20AE702		
CO	**Course Outcomes**												**Unit**	**K-CO**	**POs**	**PSOs**
CO 1	Explain the concept of Vibration and develop formulations for Degree of Freedom (D.O.F) such as Single D.O.F , Double D.O.F & Multi D.O.F.												1	K3	1,2,3,9	-
CO 2	Explain the concept of vibration absorber and different vibration measuring instruments.												1	K2	1,2,3,9	-
CO 3	Apply the concept force and vibration on tires.												2	K3	1,2,3,9	-
CO 4	Apply the concept of Vertical Dynamics related to suspension systems.												3	K3	1,2,3,9	-
CO 5	Apply the concept of Longitudinal Dynamics, control and formulating load distribution for three and four wheelers.												4	K3	1,2,3,4,9	-
CO 6	Apply the Concept of Lateral Dynamics related to vehicle handling, vehicle control and vehicle stability.												5	K3	1,2,3,4,9	-
CO – PO MAPPING																
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	
CO 1	3	3	2	-	-	-	-	-	2	-	-	-	-	-	-	
CO 2	3	3	2	-	-	-	-	-	2	-	-	-	-	-	-	
CO 3	3	3	2	-	-	-	-	-	2	-	-	-	-	-	-	
CO 4	3	3	2	-	-	-	-	-	2	-	-	-	-	-	-	
CO 5	3	3	2	2	-	-	-	-	2	-	-	-	-	-	-	
CO 6	3	3	2	2	-	-	-	-	2	-	-	-	-	-	-	

20AE7L1	ENGINE TESTING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To conduct performance test on the IC engines.
- To conduct the emission test on IC engines.
- To understand the computerized data acquisition system on IC engines.

PRE-REQUISITE:
Course Code: 20AE301, 20AE302
Course Name: Applied Thermodynamics, Automotive Engines

LIST OF EXPERIMENTS

1. Experimental study on valve timing diagram in 4-stroke engine and 2-stroke cut model.
2. Performance and emission test on two wheeler SI engine
3. Performance and emission test on automotive multi-cylinder SI engine
4. Performance and emission test on automotive multi-cylinder CI engine
5. Retardation test on I.C. Engines.
6. Heat balance test on automotive multi-cylinder SI engine
7. Heat balance test on automotive multi-cylinder CI engine
8. Morse test on multi-cylinder SI engine.
9. Engine cylinder pressure measurement P-θ and P-V diagrams for IC engine with piezo-electric pick up, charge amplifier, angle encoder and data acquisition system.
10. Motoring test for indicated power

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Hydraulic dynamometer	1 No.
2	Eddy current dynamometer	1 No.
3	Engine test rig with electrical dynamometer	1 No.
4	Single cylinder two stroke cut section engine	1 No.
5	Single cylinder four stroke cut section engine	1 No.
6	Two-wheeler engine test rig.	1 No.
7	Automotive multi cylinder SI engine test rig with heat balance arrangement	1 No.
8	Automotive multi cylinder CI engine test rig with heat balance arrangement	1 No.
9	Emission Measuring Instruments for Petrol & Diesel Engines	1 No.
10	Piezo-electric pick up, Charge Amplifier, Angle Encoder and (DDAS) Digital data acquisition system	1 No. each

OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : ENGINE TESTING LABORATORY													Course Code : 20AE7L1		
CO	**Course Outcomes**											**Unit**	**K-CO**	**POs**	**PSOs**
CO 1	Analyze the performance characteristics of internal combustion engines.											-	K4	1,2,3,4,9	-
CO 2	Analyze the emission levels of internal combustion engines.											-	K4	1,2,3,4,9	-
CO 3	Explain the valve timing and port timing diagrams in IC engines.											-	K2	1,2,3,4,9	-
CO 4	Determine the heat balance test on multi cylinder petrol engines.											-	K3	1,2,3,4,9	-
CO 5	Determine the heat balance test on multi cylinder diesel engines.											-	K3	1,2,3,4,9,10	-
CO 6	Understand the computerized data acquisition system on IC engines.											-	K2	1,2,3,4	-
CO – PO MAPPING															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO 1	3	3	3	2	-	-	-	-	1	-	-	-	-	-	-
CO 2	3	3	3	2	-	-	-	-	1	-	-	-	-	-	-
CO 3	3	3	3	2	-	-	-	-	1	-	-	-	-	-	-
CO 4	3	3	3	2	-	-	-	-	1	-	-	-	-	-	-
CO 5	3	3	3	2	-	-	-	-	1	2	-	-	-	-	-
CO 6	3	3	3	2	-	-	-	-	1	-	-	-	-	-	-

20AE7L2	VEHICLE TROUBLE SHOOTING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To be familiar with Fault diagnosis of Engine.
- To be familiar with Fault diagnosis of transmission.
- To be familiar with Fault diagnosis of brake and suspension.
- To be familiar with Fault diagnosis of Electrical system.

PRE-REQUISITE:
Course Code: 20AE302, 20AE402
Course Name: Automotive Engines, Automotive Chassis and Transmission

STUDY EXPERIMENTS:
1. Study about Tools and instruments used in the maintenance shop
2. Study and preparation of different statements/records required for the repair and maintenance works.
3. Wheel alignment procedure.

LIST OF EXPERIMENTS

1. Minor and major tune up of gasoline and diesel engines
2. Calibration of Fuel pump
3. Engine fault diagnosis using scan tool
4. Fault diagnosis of transmission system
5. Fault diagnosis of driveline system
6. Fault diagnosis of braking system
7. Fault diagnosis of suspension system
8. Fault diagnosis of steering system
9. Fault diagnosis of Electrical system like battery, starting system, charging system, lighting system etc
10. Fault diagnosis of vehicle air conditioning system
11. Practice the following:
    i. Adjustment of pedal play in clutch, brake, hand brake lever and steering wheel play.
    ii. Brake Bleeding, air bleeding of diesel fuel system.
    iii. Servicing of differential unit.
    iv. Adjustment of head lights beam.
    v. Wheel balancing of tires

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT & TOOLS	Qty.
1	Engine Analyzer	1 No.
2	Cylinder compression pressure gauge	1 No.
3	Vacuum gauge	1 No.
4	Spark plug cleaner and tester	1 No.
5	Cam angle and rpm tester	1 No.
6	Tachometer	1 No.
7	Wheel alignment apparatus	1 No.
8	Gas welding equipment	1 No.
9	Tyre remover	1 No.
10	Bearing puller	1 No.
11	Head light alignment gauge	1 No.
12	Service manuals of petrol, diesel engines	1 No: each
13	Cylinder reboring machine	1 No.
14	Valve grinding machine	1 No.
15	Valve lapping machine	1 No.
16	Fuel injection calibration test bench with nozzle tester	1 No.
17	HRD tester, Clamp on meter, Hydrometer	1 No: each
18	Wheel Balancer	1 No.

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name: VEHICLE TROUBLE SHOOTING LABORATORY															Course Code 20AE7L2			
CO	Course Outcomes														Unit	K-CO	POs	PSOs
CO 1	Understand the Workshop layouts and records														-	K2	1,2,3,8,9	-
CO 2	Understand about the tools and Equipments used in Automotive workshop														-	K2	1,2,3,8,9	-
CO 3	Explain the service of various sub systems in the vehicle														-	K2	1,2,3,8,9	-
CO 4	Explain the service of Electrical system														-	K2	1,2,3,8,9	-
CO 5	Understand the vehicle air conditioning system.														-	K2	1,2,3,8,9	-
CO 6	Understand the maintenance of automotive components like clutch, brake, steering, etc.														-	K2	1,2,3,8,9	-
CO – PO MAPPING																		
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3			
CO 1	3	3	2	-	-	-	-	1	1	-	-	-	-	-	-			
CO 2	3	3	2	-	-	-	-	1	1	-	-	-	-	-	-			
CO 3	3	3	2	-	-	-	-	1	1	-	-	-	-	-	-			
CO 4	3	3	2	-	-	-	-	1	1	-	-	-	-	-	-			
CO 5	3	3	2	-	-	-	-	1	1	-	-	-	-	-	-			
CO 6	3	3	2	-	-	-	-	1	1	-	-	-	-	-	-			

20AE801	VEHICLE BODY ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge in the construction of vehicle.
- To understand the aerodynamic concept and testing
- To be well versed in the design and construction of external body of the vehicles.

PRE-REQUISITE:

Course Code: 20AE402
Course Name: Automotive Chassis and Transmission

UNIT-I VEHICLE AERODYNAMICS 9

Objectives, Vehicle drag and types. Various types of forces and moments. Effects of forces and moments. Side wind effects on forces and moments. Various body optimization techniques for minimum drag. Wind tunnels – Principle of operation, Types. Wind tunnel testing Airflow management test – measurement of various forces and moments by using wind tunnel.

UNIT-II BUS BODY DETAILS 9

Types of bus body: based on capacity, distance traveled and based on construction.– Bus body lay out for various types, Types of metal sections used – Regulations – Constructional details: Conventional and integral.

UNIT-III COMMERCIAL VEHICLE DETAILS 9

Types of commercial vehicle bodies - Light commercial vehicle body. Construction details of commercial vehicle body - Flat platform body, Trailer, Tipper body and Tanker body – Dimensions of driver's seat in relation to controls – Drivers cab design - Regulations.

UNIT-IV CAR BODY DETAILS 9

Types of Car body - Saloon, convertibles, Limousine, Estate Van, Racing and Sports car – Visibility- regulations, driver's visibility, improvement in visibility and tests for visibility. Driver seat design -Car body construction-Various panels in car bodies. Safety aspect of car body.

UNIT-V BODY MATERIALS AND BODY REPAIR 9

Types of materials used in body construction-Steel sheet, timber, plastics, GRP, properties of materials. Hand tools-power tools-panel repair-repairing sheet metal-repairing plastics-body fillers-passenger compartment service- corrosion: Anticorrosion methods, Modern painting process procedure-paint problems

TOTAL: 45 PERIODS

TEXT BOOKS:

1. James E Duffy, "Body Repair Technology for 4-Wheelers", Cengage Learning, 2009.
2. Powloski, J., "Vehicle Body Engineering", Business Books Ltd., 1998.
3. John Fenton, "Vehicle Body layout and analysis", Mechanical Engg. Publication Ltd., London, 1992.

REFERENCES:

1. Braithwaite, J.B., "Vehicle Body building and drawing", Heinemann Educational Books Ltd., London, 1997.
2. Dieler Anselm., The passenger car body, SAE International, 2000
3. Giles, G.J., "Body construction and design", Illiffe Books Butterworth & Co., 1991.
4. John Fenton, "Vehicle Body layout and analysis", Mechanical Engg. Publication Ltd., London, 1992.

OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name: VEHICLE BODY ENGINEERING												Course Code : 20AE801			
CO	Course Outcomes											Unit	K-CO	POs	PSOs
CO 1	Identify the Various forces and moments acting on vehicle using wind tunnel.											1	K2	1,2,3,9	-
CO 2	Classify bus body and select suitable method for construction.											2	K2	1,2,3,10	-
CO 3	Evaluate and analyze the different aspects of commercial vehicle body.											3	K2	1,2,3,10	-
CO 4	Classify car body and identify the car body Parts in a vehicle.											4	K2	1,2,3,9	-
CO 5	Choose suitable material which can be used in car body, bus Body of an automobile.											5	K2	1,2,3,9	-
CO 6	Identify and describe various painting process for a Commercial vehicle and tools used for body repairs.											5	K2	1,2,3,10	-
CO – PO MAPPING															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	3	-	-	-	-	-	2	-	-	-	-	-	-
CO 2	3	3	2	-	-	-	-	-	-	1	-	-	-	-	-
CO 3	3	2	2	-	-	-	-	-	-	1	-	-	-	-	-
CO 4	3	2	3	-	-	-	-	-	1	-	-	-	-	-	-
CO 5	3	2	1	-	-	-	-	-	2	-	-	-	-	-	-
CO 6	3	2	2	-	-	-	-	-	-	1	-	-	-	-	-

20AE8L1	PROJECT WORK	L	T	P	C
		0	0	20	10

OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students in preparing project reports and to face reviews and viva voce examination

PRE-REQUISITE: ALL CORE COURSES & LABORATORIES

GUIDELINE FOR REVIEW AND EVALUATION

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 300 PERIODS

Course Name: PROJECT WORK													Course Code : 20AE8L1			
CO	Course Outcomes												Unit	K-CO	POs	PSOs
CO 1	Identify problems related with automobile domain.												-	K4	1,2,3,4,5,6,7,8, 9,10,11,12	1,2,3
CO 2	Comprehend the basic concepts of automotive technology, mechanics, science and mathematics in designing mechanical systems.												-	K4	1,2,3,4,5,6,7,8, 9,10,11,12	1,2,3
CO 3	Give solution to the problem among alternatives by applying design and theoretical back ground.												-	K4	1,2,3,4,5,6,7,8, 9,10,11,12	1,2,3
CO 4	Estimate/evaluate the cost involvement of the project and document the project work.												-	K4	1,2,3,4,5,6,7,8, 9,10,11,12	1,2,3
CO 5	Create, design and develop hardware or software for a specific real world problem.												-	K4	1,2,3,4,5,6,7,8, 9,10,11,12	1,2,3
CO 6	Prepare the project reports and give proper explanation during the presentation and demonstration.												-	K4	1,2,3,4,5,6,7,8, 9,10,11,12	1,2,3
CO – PO MAPPING																
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
CO 1	3	3	2	1	1	1	1	1	1	1	1	1	2	2	2	
CO 2	3	3	2	1	1	1	1	1	1	1	1	1	2	2	2	
CO 3	3	3	2	1	1	1	1	1	1	1	1	1	2	2	2	
CO 4	3	3	2	1	1	1	1	1	1	1	1	1	2	2	2	
CO 5	3	3	2	1	1	1	1	1	1	1	1	1	2	2	2	
CO 6	3	3	2	1	1	1	1	1	1	1	1	1	2	2	2	

Professional Elective – II

20AE7A1	AUTOMOTIVE HEATING VENTILATION AND AIR-CONDITIONING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the automotive air conditioning fundamentals.
- To understand the air conditioning heating system.
- To explain refrigerants handling system.
- To explain the air conditioner maintenance and service in vehicles

PRE-REQUISITE:
Course Code: 20AE301
Course Name: Applied Thermodynamics

UNIT-I AUTOMOTIVE AIRCONDITIONING FUNDAMENTALS **9**

Basic air conditioning system , location of air conditioning components in a car, schematic layout of a refrigeration system, compressor components, condenser and high pressure service ports, thermostatic expansion valve, expansion valve calibration, controlling evaporator temperature, evaporator pressure regulator, evaporator temperature regulator

UNIT-II AIR CONDITIONER – HEATING SYSTEM **9**

Automotive heaters, manually controlled air conditioner, heater system, automatically controlled air conditioner and heater systems, automatic temperature control, air conditioning protection, engine protection.

UNIT - III REFRIGERANT **9**

Containers handling refrigerants, tapping into the refrigerant container, refrigeration system diagnosis, diagnostic procedure, ambient conditions affecting system pressures.

UNIT - IV AIR ROUTING AND TEMPERATURE CONTROL **9**

Objectives, evaporator airflow through the recirculating unit, automatic temperature control, duct system, controlling flow, vacuum reserve, testing the air control and handling systems.

UNIT – V AIR CONDITIONER AND HEATER SERVICE **9**

Air conditioner maintenance and service, servicing heater system removing and replacing components, trouble shooting of air controlling system, compressor service.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Warren Farnell and James D.Halderman, "Auto Heating, Ventilation, and Air Conditioning systems", Pearson Prentice Hall, 4th edition 2015
2. Warren Farnell and James D.Halderman, "Automotive Heating, Ventilation, and Air Conditioning systems", Classroom Manual& shop manual , Pearson Prentice Hall, 2004
3.Boyce H.DWiggins- "Automotive Air Conditioning" - Delmar – 2002
4. William H Crouse and Donald L Anglin, "Automotive Air conditioning", McGraw Hill Inc., 1990.

REFERENCES:

1. Paul Weisler, "Automotive Air Conditioing", Reston Publishing Co. Inc., 1990.
2. Mitchell Information Services, Inc., "Mitchell Automatic Heating and Air Conditioning Systems", Prentice Hall Inc., 1989.
3. McDonald,K.L., "Automotive Air Conditioning", Theodore Audel series, 1978
4.Goings,L.F., "Automotive Air Conditioning", American Technical services, 1974.

OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Automotive Heating Ventilation and Air-conditioning													Course Code : 20AE7A1		
CO	Course Outcomes												Unit	K-CO	POs	PSOs
CO 1	Explain the fundamentals of automotive air												1	K2	1,2,3,9	-
CO 2	Understand the air conditioner and heating system												2	K2	1,2,3,10	-
CO 3	Describe the refrigerants handling in air												3	K2	1,2,3,10	-
CO 4	Understand the control mechanism for air												4	K2	1,2,3,9	-
CO 5	Explain the duct system for automotive air												4	K2	1,2,3,9	-
CO 6	Describe the maintenance and service procedure of automotive air												5	K2	1,2,3,9	-
CO – PO MAPPING																
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
CO 1	3	3	2	-	-	-	-	-	1	2	-	-	-	-	-	
CO 2	3	3	2	-	-	-	-	-	-	2	-	-	-	-	-	
CO 3	3	3	2	-	-	-	-	-	-	2	-	-	-	-	-	
CO 4	3	3	2	-	-	-	-	-	1	-	-	-	-	-	-	
CO 5	3	3	2	-	-	-	-	-	1	-	-	-	-	-	-	
CO 6	3	3	2	-	-	-	-	-	1	-	-	-	-	-	-	

20AE7A2	OFF ROAD VEHICLES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand the construction and various applications of off road vehicles.
- Explain the industrial and constructional equipments in off road vehicles.
- Explain the working of farm equipments ,special vehicles and military vehicles.

PRE-REQUISITE: NIL

UNIT-I EARTH MOVING EQUIPMENTS 9

Construction layout, capacity and applications of off road vehicle - prime mover, chassis and transmission, dumpers - safety features, safe warning system for dumper , Design aspects on dumper body, Articulated Dumpers, loaders - single bucket, Multi bucket and rotary types – bulldozers, excavators, backhoe loaders, scrappers, motor graders, power shawl, bush cutters, Bush cutters, stumpers, rippers

UNIT-II INDUSTRIAL APPLICATIONS 9

Constructional and working details of Jib crane, compactors - vibratory compactors, forklift, utility vehicles, man - lift, scissors, lift trucks, material handlers, -case studies.

UNIT - III CONSTRUCTIONAL EQUIPMENTS 9

Layout of constructional equipment Excavators, cranes, Hoist motor graders mixing machines, concrete ready mixers, Drillers, Ramming machines for construction of bridges and working principles , power generators

UNIT – IV FARM EQUIPMENTS, MILITARY VEHICLES AND SPECIAL UTILITY VEHICLES 9

Tractors, classification - working attachments, hydraulic control system, power take off, special implements, special features and constructional details of military tankers, gun carriers and transport vehicles. Oil tankers –Articulated vehicles, working -features of Ambulance, fire extinguishing vehicle.

UNIT – V VEHICLE SYSTEMS, FEATURES 9

Brake system and actuation – OCDB and dry disc caliper brakes. Body hoist and bucket operational hydraulics. Hydro-pneumatic suspension cylinders, Power steering system, Kinematics for loader and bull dozer operational linkages .Safety features, Safe warning system for dumper. Design aspects on dumper body and water tank sprinkler.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Abrosimov.K. Bran berg.A and Katayer.K., "Road making machinery", MIR Publishers, Moscow, 1971.
2. Nakra C.P., “Farm machines and equipments” Dhanpatrai Publishing company Pvt. Ltd.
3. Robert L Peurifoy, “Construction, planning, equipment and methods” Tata McGraw Hill Publishing company Ltd.
4. SAE Handbook Vol. III., Society of Automotive Engineers, 1997
5. Wong.J.T., "Theory of Ground Vehicles”, John Wiley & Sons, New York, 1987.

REFERENCES:

1. Bart H Vanderveen, "Tanks and Transport Vehicles", Frederic Warne and Co Ltd., London. S. Ageikin, “Off the Road Wheeled and Combined Traction Devices: Theory and Calculation”, Ashgate Publishing Co. Ltd. 1988.
2. Schulz Erich.J, "Diesel equipment I & II", McGraw Hill company, London, 1982.
3. Satyanarayana. B., "Construction planning and equipment", standard publishers and distributors, New Delhi, 2010

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name: OFF ROAD VEHICLES												Course Code : 20AE7A2			
CO	Course Outcomes											Unit	K-CO	POs	PSOs
CO 1	Explain the construction and layout of earth moving machines.											1	K3	1,2,3,4,9	-
CO 2	Infer the different types of subsystem and its functioning used in the construction of off road vehicle.											1	K3	1,2,3,4,10	-
CO 3	Understand the construction and working of industries equipments.											2	K3	1,2,3,4,9	-
CO 4	Classify and observe the application of special purpose vehicles in construction activities.											3	K3	1,2,3,4,9	-
CO 5	Illustrate the construction of farm equipments and understand the construction of military vehicles.											4	K3	1,2,3,4,10	-
CO 6	Identify the design requirements of off road vehicles											5	K2	1,2,3,4,9	-
CO – PO MAPPING															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2	2	1	-	-	-	-	2	-	-	-	-	-	-
CO 2	3	2	2	1	-	-	-	-	-	2	-	-	-	-	-
CO 3	3	2	2	1	-	-	-	-	2	-	-	-	-	-	-
CO 4	3	2	2	1	-	-	-	-	2	-	-	-	-	-	-
CO 5	3	2	2	1	-	-	-	-	-	2	-	-	-	-	-
CO 6	3	2	2	1	-	-	-	-	1	-	-	-	-	-	-

20AE7A3	NOISE, VIBRATION AND HARNESS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To acquire knowledge on sources of noise, vibration and harshness
- To Understand the effect of noise on human comfort and environment
- To explain measurement techniques and control techniques of vibration and noise

PRE-REQUISITE:

Course Code: 20AE401
Course Name: Mechanics of Machines

UNIT-I INTRODUCTION TO NOISE, VIBRATION AND HARSHNESS 9

Definition of Noise, Vibrations & Harshness in reference to Vehicular application - Noise - Definition, basic attributes of sound and units (wavelength, period, frequency velocity, speed, pressure, power and sound intensity - sound wave - properties, sound sources, sound propagation in the atmosphere, sound radiation from Structures - General Introduction to Vibration, free and forced vibration, undamped and damped vibration, linear and non linear vibration.

UNIT-II EFFECTS OF NOISE AND VIBRATION ON PEOPLE 9

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, rating measures, and procedures for determining human response to noise and vibration.

UNIT - III TRANSPORTATION NOISE AND VIBRATION – SOURCES, PREDICTION AND CONTROL 9

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

UNIT - IV TRANSDUCERS AND MEASUREMENT TECHNIQUES 9

Transducers and exciters - Sound pressure, intensity and power measurement. Sound level meters, noise dosimeters, analyzers and signal generators, equipment for data acquisition and digital signal processing - Calibration of measurement microphones, calibration of shock and vibration transducers, metrology and traceability of vibration and shock measurements.

UNIT – V NOISE AND VIBRATION IN INTERIOR TRANSPORTATION AND SAFETY 9

Interior Transportation Noise and Vibration - Introduction - Automobile, Bus, and Truck Interior Noise and Vibration Prediction and Control, Noise and Vibration in Off-Road Vehicle Interiors-Prediction and Control - Study of NVH - Legislations applicable for vehicles in India-Safety - Passive safety Active safety. Study of Safety Regulations for vehicular application.

TOTAL: 45 PERIODS

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
3. Xu Wang, Vehicle Noise and Vibration Refinement, Sawston, Cambridge: Woodhead PublishingLtd, 2010.

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

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OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : NOISE, VIBRATION AND HARNESS		Course Code : 20AE7A3			
CO	Course Outcomes	Unit	K-CO	POs	PSOs
CO1	Explain the basic concept of vibration, sources of vibration and noises in automobiles.	1	K2	1,2,3,9	-
CO 2	Describe the effect of noise and vibration on human beings and nature.	2	K2	1,2,3,10	-
CO 3	Explain the various methods to predict and control the noise and vibration in different components of automobiles.	3	K2	1,2,3,10	-
CO 4	Determine the suitable transducers to reduce the noise and vibration in automobiles.	4	K2	1,2,3,9	-
CO 5	Explain the different NVH controlling techniques in an interior transportation and safety precautions	5	K2	1,2,3,9	-
CO6	Apply the engineering techniques, tools, for measurement methods in order to learn to control and solve complex Vehicle vibrations behaviour /as well as performance problems.	5	K2	1,2,3,9	

CO – PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	2	-	-	-	-	-	1	2	-	-	-	-	-
CO 2	3	3	2	-	-	-	-	-	-	2	-	-	-	-	-
CO 3	3	3	2	-	-	-	-	-	-	2	-	-	-	-	-
CO 4	3	3	2	-	-	-	-	-	1	-	-	-	-	-	-
CO 5	3	3	2	-	-	-	-	-	1	-	-	-	-	-	-
CO 6	3	3	2	-	-	-	-	-	1	-	-	-	-	-	-

20AE7A4	ENGINE AND VEHICLE MANAGEMENT SYSTEM	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the fundamental of automotive electronics
- To understand the functions of the various types of sensors
- To explain control and working of SI engine management system
- To describe the function of various module of CI engine management system.
- To explain various types of vehicle management system

PRE-REQUISITE:
Course Code: 20AE302, 20AE501
Course Name: Automotive Engines, Automotive Electrical and Electronics

UNIT I FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS 9

Microprocessor architecture, open and closed loop control strategies, PID control, Look up tables, introduction to modern control strategies like Fuzzy logic and adaptive control. Parameters to be controlled in SI and CI engines and in the other parts of the automobile.

UNIT II SENSORS 9

Inductive, Hall effect, hot wire, thermistor, piezo electric, piezoresistive, based sensors. Throttle position, mass air flow, crank shaft position, cam position, engine and wheel speed, steering position, tire pressure, brake pressure, steering torque, fuel level, crash, exhaust oxygen level (two step and linear lambda), knock, engine temperature, manifold temperature and pressure sensors, gyro sensors.

UNIT III SI ENGINE MANAGEMENT 9

Three way catalytic converter, conversion effciency versus lambda. Layout and working of SI engine management systems like Bosch L-Jetronic and LH-Jetronic. Group and sequential injection techniques. Working of the fuel system components. Cold start and warm up phases, idle speed control, acceleration and full load enrichment, deceleration fuel cutoff. Fuel control maps, open loop control of fuel injection and closed loop lambda control. Electronic ignition systems and spark timing control. Closed loop control of knock.

UNIT IV CI ENGINE MANAGEMENT 9

Fuel injection system parameters affecting combustion, noise and emissions in CI engines. Pilot, main, advanced post injection and retarded post injection. Electronically controlled Unit Injection system. Layout of the common rail fuel injection system. Working of components like fuel injector, fuel pump, rail pressure limiter, flow limiter, EGR valves

UNIT V VEHICLE MANAGEMENT SYSTEMS 9

ABS system, its need, layout and working. Electronic control of suspension – Damping control, Electric power steering, Supplementary Restraint System of air bag system – crash sensor, seat belt tightening. Cruise control. Vehicle security systems- alarms, vehicle tracking system. On board diagnostics. Collision avoidance Radar warning system.

Total: 45 Periods

TEXT BOOKS:

. 1. Eric Chowanietz "Automobile Electronics" SAE Publications, 1994
2. William B Ribbens "Understanding Automotive Electronics", SAE Publications, 1998

REFERENCES:

1. Robert Bosch "Diesel Engine Management" SAE Publications, 2006.
2. Robert Bosch, "Gasoline Engine Management" SAE Publications, 2006.

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : ENGINE AND VEHICLE MANAGEMENT SYSTEM												Course Code : 20AE7A4			
CO	Course Outcomes											Unit	K-CO	POs	PSOs
CO 1	Explain the fundamental of automotive electronics											1	K2	1,2,3,4,9	-
CO 2	Describe the functions of the various types of sensors											2	K2	1,2,3,4,10	-
CO 3	Illustrate the control and working of SI engine management system											3	K2	1,2,3,4,9	-
CO 4	Describe the function of various module of CI engine management system											4	K2	1,2,3,4,9	-
CO 5	Explain the various types of control system in Vehicles											5	K2	1,2,3,4,10	-
CO 6	Describe the functions of various safety devices											5	K2	1,2,3,4,9	-

CO – PO MAPPING															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2	2	1	-	-	-	-	2	-	-	-	-	-	-
CO 2	3	2	2	1	-	-	-	-	-	2	-	-	-	-	-
CO 3	3	2	2	1	-	-	-	-	2	-	-	-	-	-	-
CO 4	3	2	2	1	-	-	-	-	2	-	-	-	-	-	-
CO 5	3	2	2	1	-	-	-	-	-	2	-	-	-	-	-
CO 6	3	2	2	1	-	-	-	-	1	-	-	-	-	-	-

20AE7A5	VEHICLE MAINTENANCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the maintenance of records and schedules.
- To understand the engine and engine sub system maintenance.
- To explain the transmission and driveline maintenance.
- To describe the maintenance of steering, brake ,suspension and wheel.
- To explain maintenance of electrical components in a vehicle.

PRE-REQUISITE:

Course Code: 20AE302, 20AE402
Course Name: Automotive Engine, Automotive Chassis and Transmission

UNIT-I MAINTENANCE OF RECORDS AND SCHEDULES 9

Importance of maintenance, preventive (scheduled) and breakdown (unscheduled) maintenance, requirements of maintenance, preparation of check lists. Inspection schedule, maintenance of records, log sheets and other forms, safety precautions in maintenance. service schedule (Manufacture Km service) and service history maintenance. Automobile garages, type of layout and special tools used.

UNIT-II ENGINE AND ENGINE SUBSYSTEM MAINTENANCE **9**

General Engine service- Dismantling of Engine components- Engine repair- working on the underside, front, top, ancillaries- Service of basic engine parts, cooling and lubricating system, fuel system, Intake and Exhaust system, electrical system - Electronic fuel injection and engine management service - fault diagnosis- servicing emission controls

UNIT - III TRANSMISSION AND DRIVELINE MAINTENANCE **9**

Clutch- general checks, adjustment and service- Dismantling, identifying, checking and reassembling transmission, transaxle- road testing- Removing and replacing propeller shaft, servicing of cross and yoke joint and constant velocity joints- Rear axle service points- removing axle shaft and bearings- servicing differential assemblies- fault diagnosis.

UNIT - IV STEERING, BRAKE, SUSPENSION, WHEEL MAINTENANCE 9

Inspection, Maintenance and Service of Hydraulic brake, Drum brake, Disc brake, Parking brake. Bleeding of brakes. Inspection, Maintenance and Service of Mc person strut, coil spring, leaf spring, shock absorbers. Dismantling and assembly procedures. Inspection, Steering systems, overhauling and maintenance., Wheel alignment

UNIT – V ELECTRICAL SYSTEM MAINTENANCE SERVICING ANDREPAIRS **9**

Testing methods for checking electrical components, checking battery, starter motor, charging systems, DC generator and alternator, ignitions system, lighting systems Fault diagnosis and maintenance of modern electronic controls, checking and servicing of dash board instrument- Diagnose troubles and Remedies.

TOTAL: 45 PERIODS

TEXT BOOKS:

1.Ed May, "Automotive Mechanics Volume One" and Two ,McGraw Hill Publications, eighth edition, 2009

2. Vehicle Service Manuals of reputed manufacturers

REFERENCES:

1. Bosch Automotive Handbook, Tenth Edition, 2018

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OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : VEHICLE MAINTENANCE													Course Code : 20AE7A5		
CO	Course Outcomes												Unit	K-CO	POs	PSOs
CO1	Explain the various forms and records of vehicle maintenance documents.												1	K2	1,2,3,9	-
CO 2	Describe the maintenance and servicing of cooling system and lubrication system.												2	K2	1,2,3,10	-
CO 3	Explain the maintenance and servicing clutch and transmission.												3	K2	1,2,3,10	-
CO 4	Describe the maintenance and servicing of steering, brake, suspension and wheel.												4	K2	1,2,3,9	-
CO 5	Explain the maintenance and servicing of electrical.												5	K2	1,2,3,9	-
CO6	Describe the fault diagnoses in the electrical components												5	K2	1,2,3,9	
CO – PO MAPPING																
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
CO 1	3	3	2	-	-	-	-	-	1	2	-	-	-	-	-	
CO 2	3	3	2	-	-	-	-	-	-	2	-	-	-	-	-	
CO 3	3	3	2	-	-	-	-	-	-	2	-	-	-	-	-	
CO 4	3	3	2	-	-	-	-	-	1	-	-	-	-	-	-	
CO 5	3	3	2	-	-	-	-	-	1	-	-	-	-	-	-	
CO 6	3	3	2	-	-	-	-	-	1	-	-	-	-	-	-	

20AE7A6 ALTERNATIVE FUELS AND ENERGY SYSTEMS **L T P**
3 0 0

OBJECTIVES:

- To know about the types of alternative fuels and energy sources for IC engines
- To study the properties of vegetable oils.
- To understand the production methods of alcohols and their properties.
- To study the production methods of gaseous fuels like Biogas, NG, CNG and LPG.

PRE-REQUISITE:
Course Code: 20AE504
Course Name: Automotive Fuels and Lubricants

UNIT-I Introduction 9

Energy scenario in India - Energy and Environment Overview - Importance of Alternate Energy sources - Availability of Alternate Energy Sources for SI and CI Engines - Emission standards and measuring techniques.

UNIT-II Vegetable Oil as fuels **9**

Availability of vegetable oils - Non-edible oils as biodiesel - Blending, Emulsification, Preheating and transesterification - Effect of vegetable oils physical and chemical characteristics on biodiesel properties - Estimation of Physical and chemical properties - Performance, Emission and Combustion Characteristics in diesel engines.

UNIT - III Alcohols as Fuels **9**

Production methods of alcohols - Production of alcohol from biomass - Properties of alcohols as fuels - Methods of using alcohols in CI and SI engines - Blending, dual fuel operation, fumigation, surface ignition and oxygenated additives - Performance, emission and combustion characteristics in CI and SI engines.

UNIT - IV Gaseous Fuels 9

Production methods of Biogas, NG, CNG and LPG - Biogas Digester – Reactions -Viability - Economics - Physical and chemical properties - Modification required in SI and CI Engines - Performance and emission characteristics of Biogas, NG and LPG in SI and CI engines

UNIT – V Hybrid Electrical Vehicle **9**

Introduction to HEV -Types of motors, battery pack, and accessories - HEV Classification - Layout of series, parallel and combined HEV - Degree of Hybridization(strong, medium, mild/micro, Plug- in - Fuel cell Hybrid, Hydraulic Hybrid, Pneumatic Hybrid - Advantages and Disadvantages of HEV.

TOTAL: 45 PERIODS

TEXT BOOKS:

1.AyhanDemirbas, —Biodiesel A Realistic Fuel Alternative for Diesel Enginesǁ, Springer-Verlag London Limited, 2016.

2.Richard Folkson, —Alternative Fuels and Advanced Vehicle Technologies for Improved Environmental Performanceǁ, Wood head Publishing Ltd., 2020.

REFERENCES:

1. 1. S.S .Thipse, Alternate Fuels Concepts, Technologies and Dvelopments, Delhi : Jaico Publishing House, 2020.
2. V. Ganesan, Internal Combustion Engines, New Delhi : Tata Mcgraw Hill Publishing Co.Ltd 2016.
3. L .Mathur, R.P. Sharma, Internal Combustion Engines, New Delhi :Dhanpat Rai Publications (P),Ltd, 8th edition, 2017.
4. R. L. Bechfold, Alternative Fuels Guide Book, Warrendale : SAE International,2010.
5. Alcohols as motor fuels progress in technology, Series No.19,USA: SAE Publication, 1990

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OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : **Alternative Fuels and Energy Systems**													Course Code : 20AE7A6		
CO	Course Outcomes												Unit	K-CO	POs	PSOs
CO1	Explain the emission standards and measuring techniques.												1	K2	1,2,3,4,9	-
CO 2	Differentiate the conventional fuels and alternative fuels.												1	K2	1,2,3,4,10	-
CO 3	Compare the properties of various vegetable oil and explain the performance Emission and combustion characteristics												2	K2	1,2,3,4,9	-
CO 4	Describe the Performance, emission and combustion characteristics of alcohol used in CI and SI Engines.												3	K2	1,2,3,4,9	-
CO 5	Explain the Performance and emission characteristics of biogas, NG and LPG in SI and CI engines.												4	K2	1,2,3,4,10	-
CO6	Explain the Working principle of hybrid and fuel cell powered Vehicle.												5	K2	1,2,3,4,9	
CO – PO MAPPING																
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	
CO 1	3	2	2	1	-	-	-	-	2	-	-	-	-	-	-	
CO 2	3	2	2	1	-	-	-	-	-	2	-	-	-	-	-	
CO 3	3	2	2	1	-	-	-	-	2	-	-	-	-	-	-	
CO 4	3	2	2	1	-	-	-	-	2	-	-	-	-	-	-	
CO 5	3	2	2	1	-	-	-	-	-	2	-	-	-	-	-	
CO 6	3	2	2	1	-	-	-	-	1	-	-	-	-	-	-	

20AE7B1 LEAN METHODS FOR AUTOMOBILE ENGINEERS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study the basic concepts and importance of lean manufacturing (LM)
- To study about the various tools of lean manufacturing
- To understand the implementation of Lean methods in Industries

PRE-REQUISITE: NIL

UNIT-I INTRODUCTION 9

History –Basic concepts of TQM- TPS - Objectives - Implications of lean. Traditional Manufacturing vs lean manufacturing, Benefits of Lean –Importance of Lean methods in Automobile Industries.

UNIT-II LEAN CONCEPTS 9

Eight Types of waste -Value creation - Takt time – Takt time calculation. Continuous flow - Continuous improvement / Kaizen. Lean Culture - worker involvement. Lean administration / service, Lean product development- Group Technology.

UNIT – III LEAN METHODS 9

Value Stream Mapping: detailed process map - Machine cell design -Elimination of waste - 5S principles – One piece flow - Pull vs Push - JIT - Kanban. Role of Information technology in Lean methods – Industry 4.0

UNIT – IV LEAN TOOLS 9

Standard work - Spaghetti diagram – Process Map. Visual controls - Marquee - Andon - Vision system - Score board. TPM - OEE - Changeover/setup time (SMED) - Batch size reduction -Line balancing - Failure mode and effect analysis (FMEA) - Poka-yoke/ Error mistake proofing

UNIT – V LEAN IMPLEMENTATION 9

Road map to implementation of lean project -Lean six sigma- Best practices and Case studies in Automobile Industries.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Jeffrey Liker and Gary L. Convis, "The Toyota Way to Lean Leadership: Achieving and Sustaining Excellence through Leadership Development", McGraw Hills, 2012.
2. TaiichiOhno and Norman Bodek, "Toyota Production System: Beyond Large-Scale Production", 1988. ISBN-13: 978-0915299140
3. Askin R G and Goldberg J B, “Design and Analysis of Lean Production Systems”, John Wiley and Sons Inc., 2003.

REFERENCES:

1. Michael L George, David T Rowlands, Bill Kastle, “What is Lean Six Sigma”, McGraw Hill, New York, 2004.
2. Micheal Wader, “Lean Tools: A Pocket Guide to Implementing Lean Practices”, Productivity and Quality Publishing Pvt Ltd, 2002.
3. Kenichi Sekine, “One-Piece Flow”, Productivity Press, Portland, Oregon, 1992.

OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name: LEAN METHODS FOR AUTOMOBILE ENGINEERS		Course Code : 20AE7A7			
CO	Course Outcomes	Unit	K-CO	POs	PSOs
CO 1	Understand the principles of TQM, TPS and its importance in Automobile Industries	1	K2	1,2,7,8	-
CO 2	Understand about the different types of waste and lean culture in organization.	2	K2	1,2,7,8	-
CO 3	Understand the concepts VSM,JIT and Kanban	3	K2	1,2,7,8,9	-
CO 4	Understand and Apply the concepts TPM, SMED	4	K2	1,2,7,8	-
CO 5	Understand and apply the concepts of FMEA and Poka Yoke.	4	K2	1,2,7,8,9	-
CO 6	Understand the implementation of lean tools in Industries.	5	K2	1,2,7,8	-

CO – PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	1	-	-	-	-	1	1	-	-	-	-	-	-	-
CO 2	2	1	-	-	-	-	1	1	-	-	-	-	-	-	-
CO 3	2	1	-	-	-	-	1	1	1	-	-	-	-	-	-
CO 4	2	1	-	-	-	-	1	1	-	-	-	-	-	-	-
CO 5	2	1	-	-	-	-	1	1	1	-	-	-	-	-	-
CO 6	2	1	-	-	-	-	1	1	-	-	-	-	-	-	-

20HS6A1	INTELLECTUAL PROPERTY RIGHTS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To get an adequate knowledge on patent and copyright for their innovative research works.
- To use in their career, information in patent documents provide useful insight on novelty of their idea from state-of-the art search. This provides further way for developing their idea or innovations.
- To pave the way to catch up Intellectual Property (IP) as a career option.
    - R & D IP Counsel
    - Government Jobs – Patent Examiner
    - Private Jobs
    - Patent agent and Trademark agent
    - Entrepreneur

PRE-REQUISITE: NIL

UNIT-I OVERVIEW OF INTELLECTUAL PROPERTY 9

Introduction and the need for intellectual property right (IPR) - Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design - Genetic Resources and Traditional Knowledge - Trade Secret - IPR in India: Genesis and development - IPR in abroad - Major International Instruments concerning Intellectual Property Rights: Paris Convention - 1883, the Berne Convention - 1886, the Universal Copyright Convention - 1952, the WIPO Convention - 1967, the Patent Co-operation Treaty - 1970, the TRIPS Agreement - 1994.

UNIT-II PATENTS 9

Patents - Elements of Patentability: Novelty, Non Obviousness (Inventive Steps), Industrial Application - Non-Patentable Subject Matter - Registration Procedure - Rights and Duties of Patentee - Assignment and license - Restoration of lapsed Patents - Surrender and Revocation of Patents - Infringement - Remedies & Penalties - Patent office and Appellate Board.

UNIT - III COPYRIGHTS 9

Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works - cinematograph films and sound recordings - Registration Procedure - Term of protection - Ownership of copyright - Assignment and license of copyright - Infringement - Remedies & Penalties - Related Rights - Distinction between related rights and copyrights.

UNIT – IV TRADEMARKS 9

Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board.

UNIT – V OTHER FORMS OF IP & REGISTRATION PROCESS 9

Design: meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection. Geographical Indication (GI): meaning, and difference between GI and trademarks - Procedure for registration, effect of registration and term of protection. IPR registration process through government website-modalities and publications. Plant Variety Protection: meaning and benefit sharing and farmers' rights – Procedure for registration, effect of registration and term of protection. Layout Design Protection: meaning – Procedure for registration, effect of registration and term of protection.

TOTAL:45 PERIODS

TEXTBOOK:

1. K.V.Nithyananda, "Intellectual Property Rights: Protection and Management", Cengage Learning India Pvt. Ltd., 2019.
2. P.Neeraj and D.Khusdeep, "Intellectual Property Rights", PHI Learning Pvt. Ltd., 2014.

REFERENCES:

1.V.K.Ahuja, "Law Relating to Intellectual Property Rights", Lexis Nexis, Third Edition, 2017.
2. Journal of Intellectual Property Rights (JIPR): NISCAIR
3. Cell for IPR Promotion and Management (http://cipam.gov.in/)
4. World Intellectual Property Organization (https://www.wipo.int/about-ip/en/)
5. Office of the Controller General of Patents, Designs & Trademarks (http://www.ipindia.nic.in/)

OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name: INTELLECTUAL PROPERTY RIGHTS												Course Code : 20HS6A1			
CO	Course Outcomes											Unit	K-CO	Pos	PSOs
CO 1	Explain the fundamental aspects of Intellectual property Rights which plays a major role in development and management of innovative projects in industries.											1	K2	1,2,8	-
CO 2	Describe the patents, patent regime in India and abroad and registration aspects.											2	K2	1,2,8	-
CO 3	Describe the copyrights and its related rights and registration aspects.											3	K2	1,2,8	-
CO 4	Explain the trademarks and registration aspects.											4	K2	1,2,8	-
CO 5	Explain the Design, Geographical Indication (GI), Plant Variety and Layout Design Protection and their registration aspects.											5	K2	1,2,8	-
CO 6	Analyze the current trends in IPR and Government steps in fostering IPR											5	K3	,2,3,8	-
CO – PO MAPPING															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	1	-	-	-	-	-	1	-	-	-	-	-	-	-
CO 2	2	1	-	-	-	-	-	1	-	-	-	-	-	-	-
CO 3	2	1	-	-	-	-	-	1	-	-	-	-	-	-	-
CO 4	2	1	-	-	-	-	-	1	-	-	-	-	-	-	-
CO 5	2	1	-	-	-	-	-	1	-	-	-	-	-	-	-
CO 6	2	1	-	-	-	-	-	1	-	-	-	-	-	-	-

20HS7A2 **TOTAL QUALITY MANAGEMENT** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand TQM concepts.
- To know about TQM principles.
- To understand Six Sigma, Traditional tools, New tools, Benchmarking and FMEA.
- To understand Taguchi's Quality Loss Function, Performance Measures and apply QFD, TPM, COQ and BPR.
- To apply QMS and EMS in any organization.

PRE-REQUISITE: NIL

UNIT I INTRODUCTION **9**

Quality – Need, Evolution, Definitions, Dimensions of product and service quality. TQM – Basic concepts, Framework, Contributions of Deming, Juran and Crosby, Barriers. Quality statements, Customer satisfaction, Customer complaints, Customer retention, Costs of quality.

UNIT II TQM PRINCIPLES **9**

Strategic quality planning, Quality Councils, Employee involvement, Motivation, Empowerment, Teamwork, Quality circles, Recognition and Reward, Performance appraisal, Continuous process improvement - PDCA cycle, 5S, Kaizen, Supplier partnership, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS AND TECHNIQUES I **9**

Traditional tools of quality, New management tools. Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT, Bench marking, Reason to bench mark, Bench marking process, FMEA - Stages, Types.

UNIT IV TQM TOOLS AND TECHNIQUES II **9**

Control Charts, Process Capability, Quality Function Development (QFD), Taguchi quality loss function, TPM - Concepts, improvement needs, Performance measures.

UNIT V QUALITY SYSTEMS **9**

Need for ISO 9000, ISO 9001-2008 Quality System, Elements, Documentation, Quality Auditing, QS 9000 - ISO 14000, Concepts, Requirements and Benefits, TQM Implementation in manufacturing and service sectors.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Dale H. Besterfiled, et at., "Total quality Management", Pearson Education Asia, 5th Edition, 2018.
2. James R. Evans and William M. Lindsay, "The Management and Control of Quality", Cengage Learning, 8th Edition, 2012.
3. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2nd Edition, 2006.

REFERENCES:

1. Joel.E. Ross, "Total Quality Management – Text and Cases", CRC Press, 5th Edition, 2017.
2. Kiran.D.R, "Total Quality Management: Key concepts and case studies, Butterworth – Heinemann Ltd, 1st Edition, 2016.
3. Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, 3rd Edition, 2012.
4. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 1st Edition, 2006.
5. Brue G, "Six Sigma for Managers", Tata-McGraw Hill, 2nd Edition, 2002.

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : **TOTAL QUALITY MANAGEMENT**		Course Code : **20HS7A2**			
CO	Course Outcomes	Unit	K-CO	POs	PSOs
CO 1	Explain basic concepts, TQM framework, Barriers and Benefits of TQM.	1	K2	1,2,3,9	-
CO 2	Explain the TQM Principles for application.	2	K2	1,2,10	-
CO 3	Define the basics of Six Sigma and Traditional tools, New tools, Benchmarking and FMEA.	3	K2	1,2,3,9	-
CO 4	Describe Taguchi's Quality Loss Function, Performance Measures and apply Techniques like QFD, TPM, COQ and BPR.	4	K2	1,2,3,10	-
CO 5	Illustrate and apply QMS and EMS in any organization.	5	K2	1,2,3,9	-
CO 6	Explain the TQM implementation in Manufacturing and Service sectors	5	K3	1,2,3,10	-

CO – PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2	1	-	-	-	-	-	2	-	-	-	-	-	-
CO 2	3	2	1	-	-	-	-	-	-	1	-	-	-	-	-
CO 3	3	2	1	-	-	-	-	-	2	-	-	-	-	-	-
CO 4	3	2	1	-	-	-	-	-	-	1	-	-	-	-	-
CO 5	3	2	1	-	-	-	-	-	2	-	-	-	-	-	-
CO 6	3	2	1	-	-	-	-	-	-	1	-	-	-	-	-

20HS601	OPERATIONS RESEARCH	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide knowledge about optimization techniques and approaches.
- To formulate a real time problem as a mathematical programming model.
- To gain mathematical, computational and communication skills for solving problems.
- To gain knowledge to solve networking and inventory problems.
- To gain knowledge on solving different waiting line models.

PRE-REQUISITE: NIL

UNIT-I LINEAR PROGRAMMING 9

Introduction to Operations Research, Linear programming (LP) – assumptions, **properties of LP solutions**, Formulations of linear programming problem – Graphical method. Solutions to LPP – simplex, Big M method

UNIT-II TRANSPORTATION AND ASSIGNMENT MODEL 9

Transportation Problem - Mathematical Model, Types – Balanced and Unbalanced, Solution to Transportation Problem - Finding the initial basic solution, Optimizing the basic feasible solution applying U–V Method(Modi method) Assignment problem –Hungarian method, Travelling salesman problem - Branch and Bound technique.

UNIT – III NETWORK MODELS 9

Network problem: shortest path – Systematic method, Dijkstra's algorithm, Floyd's algorithm Minimal spanning tree – PRIM and Kruskal's algorithm, Maximum flow models – linear programming models, maximal flow problem algorithm-Project network representation, Critical Path Method computations, construction of time schedule, linear programming formulation of CPM, PERT networks.

UNIT – IV INVENTORY MODELS 9

Inventorymodels, Quantity Discount, Purchase Inventory Model - Q System, P System, Multiple-item Model - Shortage Limitation, Inventory Carrying Cost Constraint, EOQ Model - Multi-item Joint Replenishment with and without Shortages, Space Constraint.

UNIT – V QUEUEING MODELS 9

Queuing models - Queuing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Hamdy A.Taha "Operations Research – An Introduction", MacMillan India Ltd., 10th Edition,2017.
2. Panneer selvam R, "Operations Research", Prentice Hall India, 2016.
3. Hira.D Gupta.P.K, "Operations Research",S. Chand Publications, 1st Edition, Reprint 2016

REFERENCES:

1. G.Srinivasan, "Operations Research: Principles and Applications", PHI Ltd., 2016.
2. Kantiswarup Gupta.P.K, Man Muhan" „Operations Research: Sultan Chand & Sons India Ltd., 12th Edition,New Delhi 2016.
3. Philips, Ravindran and Solberg, "Operations Research principle and practise", John Wiley, 2016.
4. Hiller and Liberman, Introduction to Operations Research, McGraw Hill, 2015.
5. Ramamurthy P, "Operations Research", New age International Publishers, 2nd edition, 2007.

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : OPERATIONS RESEARCH											Course Code : 20HS601				
CO	Course Outcomes										Unit	K-CO	POs		
CO 1	Solve Linear Programming Problems by appropriate technique.										1	K3	1,2,3,8,10		
CO 2	Determine the performance characteristics such as time and cost in solving shortest route, transportation problems with an appropriate model.										2	K3	1,2,3,9,10		
CO 3	Solve the given assignment problem with an appropriate method.										2	K3	1,2,3,8,10		
CO 4	Determine the optimal solution for a project scheduling problem.										3	K3	1,2,3		
CO 5	Determine the order quantity of goods under different constraints.										4	K3	1,2,3,8		
CO 6	Determine the solutions to single and multi channel Queuing problems.										5	K3	1,2,3,8,9,10		
CO – PO MAPPING															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2	1	-	-	-	-	2	-	2	-	-	-	-	-
CO 2	3	2	1	-	-	-	-	-	2	2	-	-	-	-	-
CO 3	3	2	1	-	-	-	-	2	-	2	-	-	-	-	-
CO 4	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	3	2	1	-	-	-	-	2	-	-	-	-	-	-	-
CO 6	3	2	1	-	-	-	-	1	2	2	-	-	-	-	-

20HS6A2	ENTREPRENEURSHIP DEVELOPMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To develop and strengthen entrepreneurial quality in students.
- To gain knowledge on Entrepreneurial Environment for nurturing the new startups
- To impart basic entrepreneurial skills like Ideation, Product development, and Project Management
- To bring the concept of Financing and Management of small enterprise.
- To implement concept of Technopreneurship more efficiently and effectively.

PRE-REQUISITE: NIL

UNIT-I INTRODUCTION 9

Definition & structure of Entrepreneurship - Entrepreneurial Culture- Origin of Entrepreneurship - Characteristics of an Entrepreneur - Qualities and Skills of Entrepreneur – Types of Entrepreneurs – Women Entrepreneurs

UNIT-II ENTREPRENEURIAL ECOSYSTEM **9**

Entrepreneurial Environment - Role of Family and Society -Entrepreneurship Development Program(EDP)- EDP Training-Institutions in support of Entrepreneurship(SIPCOT,EDC,ITCOT) - Central and State Government Industrial Policies and Regulations-Incubation.

UNIT - III PROJECT MANAGEMENT **9**

Ideation/Innovation – Product Planning and Development Process-Projects and its classification-Project life Cycle-Phases of Project Management-Project Identification and Selection- Project Formulation - Project Appraisal.

UNIT - IV LAUNCHING AND MANAGING OF SMALL ENTERPRISE 9

Ownership Structure - Financial Planning, Human resource mobilization-Operations planning-Market and channel selection. Venture capital – IT startups and its case studies

UNIT – V TECHNOPRENEURSHIP **9**

E-Commerce – Application – Benefits – Limitation – Opportunities-Resources Required-Operation & Problems, Security & Safety of Business Transaction, Encryption, Digital Signature, Cybercrime, Mode of Payment -EFT, E-check, E-Money, Credit Cards, Debit Cards, Smart Cards, M-Commerce, Application of M-Commerce

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Vasant Desai, "Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House, Sixth Edition, 2019.
2. S.S.Khanka, "Entrepreneurial Development", S.Chand and Company Limited, New Delhi,(Revised Edition) 2013.
3. Dr.R.C.Bhatia, "Entrepreneurship Business and Management", Sultan Chand &Sons.EducationalPublishers,New Delhi, 2020.

REFERENCES:

1. Drucker, Peter. "Innovation and Entrepreneurship". United Kingdom, Routledge, 2015.
2. Hisrich, "Entrepreneurship", Edition 9, Tata McGraw Hill, New Delhi, 2014.
3. Mathew Manimala, Entrepreneurship Theory at the Crossroads, Paradigms & Praxis,Biztrantra, 2nd Edition ,2005.
4. Prasanna Chandra, Projects – Planning, Analysis, Selection, Implementation and Reviews, Tata McGraw-Hill, 1996
5. Donal F Kuratko, T.V.Rao, Entrepreneurship: A South Asian Perspective, Cengage, 2012

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OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : **ENTREPRENEURSHIP DEVELOPMENT**		Course Code : **20HS6A2**			
CO	Course Outcomes	Unit	K-CO	POs	PSOs
CO1	Explain the qualities of an Entrepreneur and his Role in startup.	1	K2	8,9	-
CO 2	Illustrate the Entrepreneurial Environment for bringing more ventures	2	K2	8,9	-
CO 3	Determine the ideation, Product Development, and Project Management	3	K2	8,9,10, 11	-
CO 4	Illustrate Finance planning and capital venture	4	K2	8,9	-
CO 5	Explain the use of ownership in the small business.	5	K2	8,9,10	-
CO6	Explain the E- Commerce and M-Commerce for the Technopreneurship Development	5	K2	8,9	

CO – PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	-	-	-	-	-	-	-	2	2	-	-	-	-	-	-
CO 2	-	-	-	-	-	-	-	2	2	-	-	-	-	-	-
CO 3	-	-	-	-	-	-	-	2	2	1	1	-	-	-	-
CO 4	-	-	-	-	-	-	-	2	2	-	-	-	-	-	-
CO 5	-	-	-	-	-	-	-	2	2	1	-	-	-	-	-
CO 6	-	-	-	-	-	-	-	2	2	-	-	-	-	-	-

20HS601	PRINCIPLES OF MANAGEMENT	L	T	P
		3	0	0

OBJECTIVES:

- Study the evolution of Management And organization types
- Learn the concepts involved in Planning process
- Explain how organizing is done by manager
- Detail on Human Resource Management and , Career planning
- Learn the importance of Motivation and leadership
- Detail on directing and controlling in Management

PRE-REQUISITE: NIL

UNIT-I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management – Science or Art – Managerial roles and skills – Theories of Management- F.W.Taylor, Elton Mayo - Principles of Henry Fayol – Types of Business organization – Sole proprietorship, partnership, company- Types -public and private sector enterprises – Current trends and issues in Management.

UNIT-II PLANNING **9**

Nature and purpose of planning – process – types – objectives – MBO- Policies – Planning premises- Tools and Techniques ; Strategic planning - Types – Decision making steps and process. Rational Decision Making Process - Decision Making under different conditions.

UNIT - III ORGANISING AND STAFFING **9**

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Man Power planning- Recruitment & selection process, Training and Development, Performance Management , Career planning and management. Career Development - Career stages – Training - Performance Appraisal.

UNIT - IV DIRECTING 9

Foundations of individual and group behavior – motivation – motivation theories – Motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and role of information technology.

UNIT – V CONTROLLING **9**

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – Cost Control - Purchase Control - Maintenance Control - Quality Control

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Stephen P. Robbins & Mary Coulter, —Managementǁ, Prentice Hall (India) Pvt. Ltd., 10th Edition, 2020.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert —Managementǁ, Pearson Education, 6th Edition, 2018.

REFERENCES:

1. Stephen A. Robbins & David A. Decenzo& Mary Coulter, —Fundamentals of Managementǁ Pearson Education, 7th Edition, 2019.
2. Robert Kreitner&MamataMohapatra, — Managementǁ, Biztantra, 2008.
3. Harold Koontz & Heinz Weihrich —Essentials of managementǁ Tata McGraw Hill,2018.
4. Tripathy PC & Reddy PN, —Principles of Managementǁ, Tata McGraw Hill, 2016

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OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : **PRINCIPLES OF MANAGEMENT**												Course Code : **20HS601**			
CO	Course Outcomes											Unit	K-CO	POs	PSOs
CO1	Explain the evolution of Management and organization types											1	K2	8,9,10, 11	-
CO 2	Demonstrate the concepts involved in Planning process											2	K2	8,9,10, 11,12	-
CO 3	Describe the organizing concept and its types.											3	K2	8,9,10, 11	-
CO 4	Explain the human resource management and, career planning process.											3	K2	8,9,10, 11	-
CO 5	Illustrate the importance of Motivation and leadership.											4	K2	8,9,10, 11,12	-
CO6	Explain the directing and controlling in Management process.											5	K2	8,9,10, 11	
CO – PO MAPPING															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO 1	-	-	-	-	-	-	-	2	2	2	1	-	-	-	-
CO 2	-	-	-	-	-	-	-	2	2	2	1	1	-	-	-
CO 3	-	-	-	-	-	-	-	2	2	2	1	-	-	-	-
CO 4	-	-	-	-	-	-	-	2	2	2	1	-	-	-	-
CO 5	-	-	-	-	-	-	-	2	2	2	1	1	-	-	-
CO 6	-	-	-	-	-	-	-	2	2	2	1	-	-	-	-

20AE8A1	TRANSPORT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the personnel management for transport
- To understand the passenger transport operation and fare collection system
- To explain the insurance policies and maintenance procedure

PRE-REQUISITE: NIL

UNIT-I INTRODUCTION 9

Personnel management; objectives and functions of personnel management, psychology, sociology and their relevance to organization, personality problems. Selection process: job description, employment tests, interviewing, introduction to training objectives, advantages, methods of training, training procedure, psychological tests.

UNIT-II TRANSPORT SYSTEMS 9

Introduction to various transport systems. Advantages of motor transport.Principal function of administrative, traffic, secretarial and engineering divisions.chain of responsibility, forms of ownership by state, municipality, public body and private undertakings.

UNIT - III PASSENGER TRANSPORT OPERATION,SCHEDULING AND FARE STRUCTURE 9

Principal features of operating costs for transport vehicles with examples of estimating the costs, Fare structure and method of drawing up of a fare table, Various types of fare collecting methods, Basic factors of bus scheduling, Problems on bus scheduling.

UNIT – IV INSURANCE AND MOTOR VEHICLE ACT 9

Laws governing to use of motor vehicle &motor transport, Traffic signs, fitness certificate, registration requirements, permit insurance, constructional regulations, description of vehicle-tankers, tippers, delivery vans, recovery vans, Power wagons and fire fighting vehicles. Spread over, running time, test for competence to drive. Insurance, various types, Comprehensive, Third party insurance ,MACT(Motor Accident claim Tribunal),Hit &run case, Duty of driver in case of accident. Surveyors report.

UNIT – V MAINTENANCE 9

Preventive maintenance system in transport industry, tyre maintenance procedures. Causes for uneven tyre wear; remedies, maintenance procedure for better fuel economy, Design of bus depot layout.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. John Duke, "Fleet Management", McGraw-Hill Co, USA, 1984.
2. Kitchin.L.D., "Bus Operation", III edition, Illiffee and Sons Co., London, 1992

REFERENCES:

1. Transport development in india S.Chand &Co Pvt Ltd. Newdelhi.
2. Government Motor Vehicle Act, Publication on latest act to be used as on date

OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : **TRANSPORT MANAGEMENT**		Course Code : **20AE8A1**			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CO 1	Explain the various management functions in transport systems.	1	K2	1,2,3,9	-
CO 2	Acquire the knowledge about the operations of transport systems.	2	K2	1,2,3,10	-
CO 3	Understand the scheduling and fare structure in transport systems.	3	K2	1,2,3,10	-
CO 4	Understand the laws of motor vehicle act in transport systems.	4	K2	12,3,10	-
CO 5	Familiar with various types of vehicle insurance in motor vehicles.	4	K2	1,2,3,10	-
CO 6	Understand the various maintenance procedures in transport systems.	5	K3	1,2,3,10	-

CO – PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	2	-	-	-	-	-	1	-	-	-	-	-	-
CO 2	3	3	2	-	-	-	-	-	-	2	-	-	-	-	-
CO 3	3	3	2	-	-	-	-	-	-	2	-	-	-	-	-
CO 4	3	3	2	-	-	-	-	-	-	2	-	-	-	-	-
CO 5	3	3	2	-	-	-	-	-	-	2	-	-	-	-	-
CO 6	3	3	2	-	-	-	-	-	-	2	-	-	-	-	-

20AE8A2 **AUTOMOTIVE SAFETY**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand automotive safety in the broader context of transportationsafety.
- To explain the different types of vehicle safety systems used inautomobiles.
- To provide knowledge on the different comfort and convenience system used in automobiles.

PRE-REQUISITE:
Course Code: 20AE502
Course Name: Automotive Electrical and Electronics

UNIT-I INTRODUCTION **9**

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 ofcrumble zone, safety sandwich construction

UNIT-II SAFETY CONCEPTS **9**

Active safety: driving safety, conditional safety, perceptibility safety, operating safety, passive safety: exterior safety, interior safety, deformation behavior of vehicle body, speed and acceleration characteristics of passenger compartment on impact.

UNIT - III SAFETY EQUIPMENTS **9**

Seat belt, regulations, automatic seat belt tightener system, collapsible steering column, tiltable steering wheel, air bags, electronic system for activating air bags, bumper design for safety.

UNIT – IV COLLISION WARNING AND AVOIDANCE **9**

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 **9**

Steering and mirror adjustment, central locking system , Garage door opening system, tyre pressure control system, rain sensor system, environment information system

TOTAL:45 PERIODS

TEXT BOOKS:

1. Bosch, "Automotive Handbook", 10th Edition, SAE publication,2018.
2. George. A.Peters, Barbara. J.Peters, Automotive Vehicle Safety, CRC Press, FirstEdition, 2002.
3. Robert Bosch GmbH - "Safety, Comfort and Convenience Systems"- Wiley; 3rd edition,2007

REFERENCES:

1. Mark Gonter and Ulrich Seiffert, —Integrated Automotive Safety Handbookll, SAE Publication, 2013.
2. J. Marek, H.-P. Trah, Y. Suzuki, I. Yokomori - "Sensors for Automotive Applications "– WILEYVCH Verlag GmbH & Co. 2003
3. Ronald.K.Jurgen - "Automotive Electronics Handbook" - Second edition- McGraw-Hill Inc., -1999.

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : **AUTOMOTIVE SAFETY**		Course Code : **20AE8A2**			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CO 1	Describe the concepts of safety measures in automobiles.	1	K2	1,2,3,9	-
CO 2	Explain the concept of crumble zone.	1	K2	1,2,3,9	-
CO 3	Describe the different types of active and passive safety system used in automobiles.	2	K2	1,2,3,4,10	-
CO 4	Explain the working of passive safety components such as air bags, seatbelts.	3	K2	1,2,3,4,10	-
CO 5	Explain the collision warning and avoidance systems in automobiles.	4	K2	1,2,3,10	-
CO 6	Describe the different comfort and convenience system used inautomobiles.	5	K2	1,2,3,4,10	-

CO – PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	2	-	-	-	-	-	1	-	-	-	-	-	-
CO 2	3	3	2	-	-	-	-	-	1	-	-	-	-	-	-
CO 3	3	3	2	1	-	-	-	-	-	2	-	-	-	-	-
CO 4	3	3	2	1	-	-	-	-	-	2	-	-	-	-	-
CO 5	3	3	2	-	-	-	-	-	-	2	-	-	-	-	-
CO 6	3	3	2	1	-	-	-	-	-	2	-	-	-	-	-

20AE8A3 AUTOMOTIVE POLLUTION CONTROL

L	T	P	C
3	0	0	3

OBJECTIVES:

- To explain the effects of automotive pollution on environment.
- To understand the pollutant formation in SI& CI engine
- To be well versed in the control techniques for reduction of emission.
- To introduce the instruments for measurement of pollutants and emission standards

PRE-REQUISITE:
Course Code: 20HS401
Course Name: Environmental Science and Engineering

UNIT I INTRODUCTION **9**
Pollutants – sources – formation – effects of pollution on environment - human – transient operational effects on pollution – Regulated – Unregulated emissions - Emission Standards- Euro, Bharat Stage & Legislative Norms.

UNIT II POLLUTANT FORMATION IN SI ENGINES **9**
Chemistry of SI engine combustion – HC and CO formation in SI engines – NO formation in SI engines – Smoke emissions from SI engines – Effect of operating variables on emission formation.

UNIT III POLLUTANT FORMATION IN CI ENGINES **9**
Basics of diesel combustion – Smoke emission and its types in diesel engines – NOx emission and its types from diesel engines – Particulate emission in diesel engines. Odor, sulfur and Aldehyde emissions from diesel engines – effect of operating variables on emission formation

UNIT IV CONTROL TECHNIQUES FOR REDUCTION OF EMISSION **9**
Design modifications – Optimization of operating factors – Fuel modification – Evaporative emission control - Exhaust gas recirculation – SCR – Fumigation – Secondary Air injection – PCV 157 system – Particulate Trap – CCS – Exhaust treatment in SI engines –Thermal reactors – Catalytic converters – Catalysts – Use of unleaded petrol.

UNIT V MEASUREMENT TECHNIQUES EMISSION STANDARDS AND TEST PROCEDURE **9**
Test procedures CVS1, CVS3 – Test cycles – IDC – ECE Test cycle – FTP Test cycle – NDIR analyzer – Flame ionization detectors – Chemiluminescent analyzer – Dilution tunnel – Gas chromatograph – Smoke meters –SHED test.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Pundir. B.P., " IC Engines Combustion and Emissions" Narosa Publishers, 2010
2. Ganesan, V- "Internal Combustion Engines"- Tata McGraw-Hill Co4th edition 2012
3. Robert Bosch, "Emissions-Control Technology for Diesel Engines", BENTLEY ROBERT Incorporated, 2005
4. Springer and Patterson, "Engine Emission", Plenum Press, 1990.

REFERENCES:

1.Ramalingam.K.K.,"InternalCombustionEngines",ScitechPublications,ISBN8283716733, 9788183716734,2018
2.Automobiles and Pollution SAE Transaction, 1995
3.Heywood,J.B., "Internal Combustion Engine Fundamentals", McGraw Hill Book Co., 1995.
4.PaulDegobert – Automobiles and Pollution – SAE International ISBN-156091-563-3, 1991.

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : AUTOMOTIVE POLLUTION CONTROL												Course Code : 20AE68A3			
CO	Course Outcomes											Unit	K-CO	POs	PSOs
CO 1	Explain the norms of pollution standards.											1	K2	1,2,3,9	-
CO 2	Describe the pollutant formation in SI engines.											2	K2	1,2,3,10	-
CO 3	Explain the pollutant formation in CI engines.											3	K2	1,2,3,9	-
CO 4	Discuss the pollution control methods from automobiles.											4	K2	1,2,3,10	-
CO 5	Explain the operating variables on emission formation.											4	K2	1,2,3,9	-
CO 6	Describe the test procedure for emission.											5	K2	1,2,3,9	-
CO – PO MAPPING															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2	1	-	-	-	-	-	2	-	-	-	-	-	-
CO 2	3	2	1	-	-	-	-	-	-	1	-	-	-	-	-
CO 3	3	2	1	-	-	-	-	-	2	-	-	-	-	-	-
CO 4	3	2	1	-	-	-	-	-	-	1	-	-	-	-	-
CO 5	3	2	1	-	-	-	-	-	2	-	-	-	-	-	-
CO 6	3	2	1	-	-	-	-	-	2	-	-	-	-	-	-

20AE8A4 **AUTOMOTIVE TESTING**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the learners with the need for automotive testing methods and their importance.
- To equip them with knowledge in crash testing standards.
- To understand in various testing of wheels and brakes.
- To equip them with knowledge in energy and fuel consumption testing and guidelines.
- To understand the vehicle component related testing.

PRE-REQUISITE: NIL

UNIT I VEHICLE WIND TUNNEL TESTING AND BODY TESTING 9

Wind tunnel test requirements - Ground boundary simulation - wind tunnel selection and Reynolds number capability, model details, mounting of model, Test procedure. Body test - Dynamics simulation sled testing - Dolly roll over test - Dolly roll over fixture - vehicle roof strength test - Door system crash test

UNIT II COLLISION AND CRASH TESTING 9

Crash testing: Human Testing, Dummies, Crash worthiness, pole crash testing, near crash testing, vehicle to vehicle impact, side impact testing, crash test sensor, sensor mounting positions, crash test data acquisition, braking distance test.

UNIT III TESTING OF WHEELS AND BRAKES 9

Wheels: Dynamic cornering fatigue, dynamic radial fatigue tests-procedures, bending moment and radial load calculations. Impact test -Road hazard impact test for wheel and tyre assemblies test procedures, Failure criteria and performance criteria.

UNIT IV ENERGY AND FUEL CONSUMPTION TESTING 9

Engine cooling fan, air conditioning and brake compressors, hydraulic pumps power consumptions, ABS energy consumption.

UNIT V VEHICLE COMPONENT RELATED TESTING 9

Test Route selection, vehicle test speeds, cargo, weights, driver selection, Tested data, finding and calculations. Test on rough terrain, Pot hole with laden and unladden conditions.

.

TOTAL: 45 PERIODS

TEXT BOOKS:

1.Beck with. T.G. and Buck.N.L."Mechanical Measurements", Addition Wesley publishing company Limited, 1995.
2. Robert Bosch GmbH, —Automotive Hand Book, 9th Edition, Wiley, 2014. 2004
3. Tim Grilles, "Automotive Service" Delmar publishers, 1998

REFERENCES:

1.W.H. course& D.L. Anglin, "Automotive Mechanics" TMG publishing company, 2004
2. Judge A.W., —Modern Electrical Equipment of Automobiles: Motor Manuals Volume Six, 2nd Edition,Springer Science & Business Media, 2012.
3. Website: www.mainindia.com/Draft, AIS standards. asp.

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : AUTOMOTIVE TESTING		Course Code : 20AE8A4			
CO	Course Outcomes	Unit	K-CO	POs	PSOs
CO 1	Explain the vehicle for testing standards	1	K2	1,2,8	-
CO 2	Explain the vehicle body testing	1	K2	1,2,7,8,9	-
CO 3	Describe the vehicle test in static and dynamic conditions.	2	K2	1,2,7,8	-
CO 4	Explain all the automotive testing regulations while testing a vehicle.	3	K2	1,2,7,8	-
CO 5	Describe effectiveness and efficiency of all the components	4	K2	1,2,8,9	-
CO 6	Analyze the vehicle and report the results.	5	K4	1,2,3,7, 8	-

CO – PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	1	-	-	-	-	-	1	-	-	-	-	-	-	-
CO 2	2	1	-	-	-	-	1	1	1	-	-	-	-	-	-
CO 3	2	1	-	-	-	-	-	1	-	-	-	-	-	-	-
CO 4	2	1	-	-	-	-	1	1	-	-	-	-	-	-	-
CO 5	2	1	-	-	-	-	-	1	1	-	-	-	-	-	-
CO 6	2	1	1	-	-	-	1	1	-	-	-	-	-	-	-

20AE8A5	REGULATORY MECHANISM FOR TRANSPORTATION SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the transportation systems planning.
- To understand the traffic management.
- To understand the traffic survey methods.
- To explain the traffic control and regulation.

PRE-REQUISITE: NIL

UNIT-I TRANSPORATION SYSTEMS PLANNING 9

Types of Road-Mode of Transport-Stages in Transportation Planning-Travel Forecasting Process-Modal split models – Mode choice behavior-Traffic assignment and methods-Land Use Transport Model. Urban Transport System-Bus Transit Planning And Scheduling-Rail Transit Terminals And Performance Evaluation-Policies and Strategies for Mass Transport.

UNIT-II TRAFFIC MANAGEMENT AND STUDIES 8

Scope, traffic elements, characteristics-vehicle, road user and road; traffic studies-speed & delay, traffic volume, O & D, parking and accidents, sample size, study methodology, data collection & presentation

UNIT-III TRAFFICSURVEYS 9

Methods of conducting the study and presentation of the data for traffic volume study; speed study and origin and destination study. Speed and delay study. Parking surveys; On street parking; off street parking. Accident surveys. Causes of road accidents and preventive measures; Use of photographic techniques in traffic surveys

UNIT-IV TRAFFIC CONTROL AND SIGNAL DESIGN 10

Types of traffic control devices. Traffic signs; general principles of traffic signing; types of traffic signs. Road markings; types; general principles of pavement markings. Design of rotary.
Grade separated intersections. Miscellaneous traffic control aids and street furniture.
Types of signals. Linked or coordinated signal systems. Design of signal timings by trial cycle method; approximate method; Webstor's method and IRC method

UNIT-V TRAFFIC REGULATION AND MEASURES 9

Need and scope of traffic regulations. Regulation of speed; vehicles and drivers. General traffic regulations. Motor vehicle act. Scope of traffic management. Traffic management measures: restrictions on turning movements; one way streets; tidal flow operations; exclusive bus lanes; traffic restraint; road pricing.

TOTAL : 45 PERIODS

TEXT BOOKS:

1.Traffic Engineering and Transportation Planning – L.R. Kadiyali, Khanna Publishers.
2. Traffic Engineering - Theory & Practice - Louis J.Pignataro, Prentice Hall Publication.
3. “Highway Engineering”, -Khanna S. K. and Justo C. E. G., Nem Chand Bros., Roorkee

REFERENCES:

1. Matson T. M., Smith W. S. and Hurd F. W., “Traffic Engineering”, McGraw Hill, New York.
2.Principles of Highways Engineering and Traffic Analysis - Fred Mannering & Walter Kilareski, John Wiley & Sons Publication.
3. Transportation Engineering - An Introduction - C.JotinKhisty, Prentice Hall Publication
4. Fundamentals of Transportation Engineering - C.S.Papacostas, Prentice Hall India

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : **REGULATORY MECHANISM FOR TRANSPORTATION ENGINEERING**												Course Code : **20AE8A5**			
CO	**Course Outcomes**											**Unit**	**K-CO**	**POs**	**PSOs**
CO 1	Describe the various traffic planning process.											1	K2	1,2,8,9	-
CO 2	Explain the process of traffic management systems.											2	K2	1,2,8,9	-
CO 3	Identify the various methods of traffic surveys.											3	K2	1,2,8,9	-
CO 4	Explain the various traffic control devices.											4	K2	1,2,8,9	-
CO 5	Explain the traffic signs for roads.											4	K2	1,2,8,9	-
CO 6	Understand the various traffic regulations and its measures.											5	K2	1,2,9,10	-
CO – PO MAPPING															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO 1	3	2	-	-	-	-	-	1	1	-	-	-	-	-	-
CO 2	3	2	-	-	-	-	-	1	1	-	-	-	-	-	-
CO 3	3	2	-	-	-	-	-	1	1	-	-	-	-	-	-
CO 4	3	2	-	-	-	-	-	1	1	-	-	-	-	-	-
CO 5	3	2	-	-	-	-	-	1	1	-	-	-	-	-	-
CO 6	3	2	-	-	-	-	-	-	1	2	-	-	-	-	-

20ME7A2 COMPUTER INTEGRATED MANUFACTURING SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the application of computers in manufacturing systems.
- To know the concept of cellular manufacturing systems.
- To familiarize about FMS and its applications.
- To comprehend the application of automation and AGVS in industry.
- To know the application of computer for generating process planning of the product.

PRE-REQUISITE:

Course Code: 20AE404

Course Name: Manufacturing Processes and Technology

UNIT - I INTRODUCTION TO CIM AND AUTOMATION 9

Automation in Production Systems, automated manufacturing systems- types of automation, reasons for automating, Computer Integrated manufacturing, computerized elements of a CIM system, CAD/CAM and CIM.

Mathematical models and matrices: production rate, production capacity, utilization and availability, manufacturing lead time, work-in process, numerical problems.

UNIT – II CELLULAR MANUFACTURING SYSTEMS 9

Group technology-Part Families, Features and Optiz of Parts Classification and Coding Systems, Machine Cell Design, Applications Of Group Technology.

Quantitative analysis of Cellular Manufacturing, Grouping of parts and Machines by Rank Order Clustering method - Hollier Method – Simple Problems.

UNIT - III FLEXIBLE MANUFACTURING SYSTEMS 9

FMS- Flexibility – Types of FMS- Components - work stations –FMS layout configurations- Computer control and functions –Applications.

Analysis of flexible manufacturing systems – Bottleneck model – sizing the FMS –simple numerical problems.

UNIT – IV AUTOMATED ASSEMBLY SYSTEMS AND AUTOMATED GUIDED VEHICLE SYSTEM (AGVS) 9

Automation – Basic elements- power - program of instructions – control system – levels of automation. Fundamentals of automated assembly systems – system configurations - parts delivery – applications.

Automated Guided Vehicle System (AGVS) – AGVS Application – Vehicle Guidance technology – Vehicle Management & Safety.

UNIT - V COMPUTER AIDED PROCESS PLANNING SYSTEMS 9

Computer aided Process Planning – Variant process planning – Generative process planning– Forward and backward planning, input format.

Totally Integrated process planning systems – Expert process planning-Commercial systems: CAM-I, CAPP, MIPLAN, APPAS, CPPP.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Mikell.P.Groover "Automation, Production Systems and Computer Integrated Manufacturing", Pearson Education Limited, 5th Edition, 2019.
2. Radhakrishnan P, SubramanyanS.andRaju V., "CAD/CAM/CIM", New Age, International (P) Ltd, 4th Edition, 2016.
3. James A. Rehg, and Henry W Kraebber, 'Computer-Integrated Manufacturing', Pearson Education Limited, 2nd Edition, 2000.

REFERENCES:

1. Kant Vajpayee S, "Principles of Computer Integrated Manufacturing", Prentice Hall India, 2003.
2. Gideon Halevi and Roland Weill, "Principles of Process Planning – A Logical Approach", Chapman & Hall, 1995.
3. Rao. P, N Tewari&T.K. Kundra, "Computer Aided Manufacturing", Tata McGraw Hill, Publishing Company, 2000.
4. Vollmann, T.E. and Bery, W.E., "Manufacturing Planning and Control Systems, Galgotia Publications, 5th Edition, 2004.
5. YoramKoren, 'Computer Control of Manufacturing Systems', McGraw Hill Education, Indian Edition, 2017.

Course Name : COMPUTER INTEGRATED MANUFACTURING SYSTEMS		Course Code : 20AE8A6			
CO	Course Outcomes	Unit	K-CO	POs	PSOs
CO 1	Explain the knowledge about role of computer and automation in manufacturing.	1	K2	1,2,8	-
CO 2	Explain the concept of group technology, and analysis of cellular manufacturing cell.	2	K2	1,2,8,9	-
CO 3	Explain the concept of FMS, and sizing of FMS systems.	3	K2	1,2,8,10	-
CO 4	Describe the automation, types of automation and automation strategies.	4	K2	1,2,8,9	-
CO 5	Describe Automated Guided Vehicle System and its application.	4	K2	1,2,8	-
CO 6	Describe the application of computer in CAPP, and explore to integrated planning software.	5	K2	1,2,8	-

CO – PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	1	-	-	-	-	-	2	-	-	-	-	-	-	-
CO 2	2	1	-	-	-	-	-	1	1	-	-	-	-	-	-
CO 3	2	1	-	-	-	-	-	2	-	1	-	-	-	-	-
CO 4	2	1	-	-	-	-	-	1	1	-	-	-	-	-	-
CO 5	2	1	-	-	-	-	-	2	-	-	-	-	-	-	-
CO 6	2	1	-	-	-	-	-	1	-	-	-	-	-	-	-

20OE605	LEAN MANUFACTURING PRACTICES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the various tools for lean manufacturing
- To apply the above tools to implement lean manufacturing system in an organization
- To understand the problem solving methodology in Industries

PRE-REQUISITE: NIL

UNIT-I INTRODUCTION TO LEAN MANUFACTURING 9

TQM – Basic concepts, need - Conventional Manufacturing versus Lean Manufacturing – Principles of Lean Manufacturing – Basic elements of lean manufacturing – Introduction to LM Tools.

UNIT-II TYPES OF LAYOUT, JIT, TPM 9

Layout types – Product, Process, Cellular Manufacturing –, Principles of Cell layout, Implementation. JIT – Principles of JIT and Implementation of Kanban. TPM – Pillars of TPM, Principles and implementation of TPM.

UNIT - III SMED, 5S, VSM 9

Set up time reduction – Definition, philosophies and reduction approaches. 5S Principles and implementation - Value stream mapping - Procedure and principles, Kaizen.

UNIT – IV SIX SIGMA 9

Six Sigma – Definition, statistical considerations, variability reduction, design of experiments – Six Sigma implementation

UNIT – V CASE STUDIES 9

Problem solving methodology, Case studies of implementation of lean manufacturing at industries.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Design and Analysis of Lean Production Systems, Ronald G. Askin& Jeffrey B. Goldberg, John Wiley & Sons, 2003
2. Automation, Production Systems and CIM. Mikell P. Groover (2002), Prentice hall Publications
3. Rother M. and Shook J, 1999 _Learning to See: Value Stream Mapping to Add Value and Eliminate Muda' , Lean Enterprise Institute, Brookline, MA.

REFERENCES:

1. Simplified Lean Manufacture , N.Gopalakrishnana, PHI Learning PvtLTd, New Delhi
2. Production planning and control , Dr.V.Jeyakumar, Lakshmi publication
3. Total Quality Management , Dr.V.Jeyakumar , Lakshmi publication

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : **LEAN MANUFACTURING PRACTICES**													Course Code : **20OE605**		
CO	**Course Outcomes**												**Unit**	**K-CO**	**POs**	**PSOs**
CO 1	Understand the principles, elements and various tools of lean manufacturing												1	K2	1,2,3,4,10	-
CO 2	Understand the different types of layout, cellular manufacturing, implementation of JIT, Kanban, TPM												2	K2	1,2,3,4,10	-
CO 3	Apply the concepts of SMED,5S in Industries												3	K3	1,2,3,4,10	-
CO 4	Apply the concepts TQM and VSM.												3	K3	1,2,3,4,10	-
CO 5	Understand the DOE and six sigma implementation												4	K2	1,2,3,4,10	-
CO 6	Solve problems using appropriate lean tools												5	K3	1,2,3,4,10	-
CO – PO MAPPING																
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	
CO 1	2	1	2	1	-	-	-	-	-	2	-	-	-	-	-	
CO 2	2	1	2	1	-	-	-	-	-	2	-	-	-	-	-	
CO 3	2	1	2	1	-	-	-	-	-	2	-	-	-	-	-	
CO 4	2	1	2	1	-	-	-	-	-	2	-	-	-	-	-	
CO 5	2	1	2	1	-	-	-	-	-	2	-	-	-	-	-	
CO 6	2	1	2	1	-	-	-	-	-	2	-	-	-	-	-	

20OE606	MODERN VEHICLE TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart recent trending knowledge in the Automobile field.
- To develop the skills of the students in recent safety precaution principles
- To Improve efficiency, security & performance of automobile using modern electronics and technology.

PRE-REQUISITE: NIL

UNIT-I ELECTRONIC ENGINE MANAGEMENT 9

Single Point and Multipoint Injection System, Working of Electronic Fuel Injector, Different Types of Electronic Fuel Injection Systems Like L, K, KE, LU, LH and Motronic, ME & MH Systems, Cylinder Cut-Off Technology.

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UNIT-II DRIVER INFORMATION SYSTEMS 9

Introduction, Driver Support Systems – Driver Information, Driver Perception, Driver Convenience, Driver Monitoring. Vehicle Support Systems – General Vehicle Control, Collision Avoidance, Vehicle Status Monitoring.

UNIT - III DRIVER ASSISTANCE SYSTEMS 9

Global Positioning Systems, Geographical Information Systems, Navigation Systems, Automotive Vision System, Road Recognition, Driver Assistance Systems - Connected Vehicles, Autonomous Vehicles

UNIT – IV SAFETY SYSTEMS 9

Active and Passive Safety Systems, Airbags, Seat Belt Tightening System, Collision Warning Systems, Child Lock, Anti Lock Braking Systems, Traction Control, Electronic Stability Programme. Crash Worthiness of Vehicle, Vehicle Crash Testing, Testing With Dummies. Security Systems - Anti Theft Technologies, Smart Card System, Number Plate Coding.

UNIT – V COMFORT SYSTEMS 9

Active Suspension Systems, Requirement and Characteristics, Different Types, Power Steering,Collapsible and Tiltable Steering Column, Power Windows, Biometric Systems. Adaptive Control Systems: Adaptive Cruise Control, Adaptive Noise Control, Anti Spin Regulation.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. K.K. Ramalingam, “Automobile Engineering”, Scitech Publications Pvt. Ltd., 2005
2. Crouse/Anglin “Automotive Mechanics”
3. “Automotive technology “ H.Hertz, 2008

REFERENCES:

1. Beranek. L.L. Noise Reduction, McGraw-Hill Book Co., Inc, Newyork, 1993
2. Bosch Hand Book, 3rd Edition, SAE,1993
3. T. Kenneth Garrett, Kenneth Newton and William Steeds, “The Motor Vehicle” 13th Edition, Butterworth-Heinemann Limited, London, 2005.

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO

Course Name : MODERN VEHICLE TECHNOLOGY												Course Code : 20OE606			
CO	Course Outcomes											Unit	K-CO	POs	PSOs
CO 1	Explain the recent developments in Alternate power generation for a vehicle.											1	K 2	1,2,3,10	-
CO 2	List various modern features for better functioning of vehicle.											2	K 2	1,2,3,10	-
CO 3	Demonstrate the advanced suspension, Braking, and Safety systems in automobile.											3	K 2	1,2,3,10	-
CO 4	Identify the Various Vehicle operation and control systems.											4	K 2	1,2,3,10	-
CO 5	Explain the Driver support systems in Vehicle automated tracks.											4	K 2	1,2,3,10	-
CO 6	Identify and describe various advanced comfort system used in automobile											5	K 2	1,2,3,10	-
CO – PO MAPPING															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	2	-	-	-	-	-	-	2	-	-	-	-	-
CO 2	3	3	2	-	-	-	-	-	-	2	-	-	-	-	-
CO 3	3	3	2	-	-	-	-	-	-	2	-	-	-	-	-
CO 4	3	3	2	-	-	-	-	-	-	2	-	-	-	-	-
CO 5	3	3	2	-	-	-	-	-	-	2	-	-	-	-	-
CO 6	3	3	2	-	-	-	-	-	-	2	-	-	-	-	-

20OE607	NEW GENERATION AND HYBRID VEHICLES	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To illustrate the new generation vehicles and their operation and controls
- To give an exposure regarding types of Power system and new generation vehicles.
- To give an exposure regarding the various types of Vehicle automated tracks.
- To teach the basics of suspension, brakes, aerodynamics and safety.

PRE-REQUISITE: NIL

UNIT-I INTRODUCTION 9

Electric and hybrid vehicles, flexible fuel vehicles (FFV), flexible fuel systems, solar powered vehicles, fuel cells and its type, fuel cell vehicles

UNIT-II POWER SYSTEM AND NEW GENERATION VEHICLES 9

Hybrid Vehicle engines, Stratified charge engines, learn burn engines, low heat rejection engines, hydrogen engines, HCCI engine, VCR engine, surface ignition engines, VVTI engines. High energy and power density batteries

UNIT - III VEHICLE OPERATION AND CONTROL 9

Computer Control for pollution and noise control and for fuel economy – Transducers and actuators - Advanced Driver Assistance System Technology- Connected Car Technology .

UNIT – IV VEHICLE AUTOMATED TRACKS 9

Preparation and maintenance of proper road network using Intelligent Transportation System (ITS)–Components of ITS- National highway network with automated roads and vehicles – Satellite control of vehicle operation for safe and fast travel, GPS.

UNIT – V SUSPENSION, BRAKES AND SAFETY 9

Air suspension – Closed loop suspension, compensated suspension, anti skid braking system, retarders, regenerative braking, safety gauge air bags- crash resistance. Safety systems

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Bosch Hand Book, SAE Publication, 2000
2. Heinz, "Modern Vehicle Technology" Second Edition
3. Advance hybrid vehicle power transmission, SAE.

REFERENCES:

1. Advance hybrid vehicle power transmission, SAE.
2. Light weight electric for hybrid vehicle design.
3. Noise reduction, Branek L.L., McGraw Hill Book company, New York, 1999

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name: NEW GENERATION AND HYBRID VEHICLES		Course Code : 20OE607			
CO	Course Outcomes	Unit	K-CO	POs	PSOs
CO 1	Interpret the critical comparisons of HEVs with alternatives such as EVs and fuel cell systems.	1	K2	1,2,3,9	-
CO 2	Define and analyze the fundamental operations of different hybrid engines and the electrochemistry of battery operation.	2	K3	1,2,3,10	-
CO 3	Explain different approaches to control the vehicles with the aid of computer and Information Technology.	3	K3	1,2,3,10	-
CO 4	Identify how to prepare and maintain Road network using satellite and GPS control.	4	K3	1,2,3,9	-
CO 5	Demonstrate the safety features of vehicles	5	K3	1,2,3,9	-
CO 6	Identify and describe materials used for safety precautions in vehicles.	5	K3	1,2,3,9	-

CO – PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	2	-	-	-	-	-	1	2	-	-	-	-	-
CO 2	3	3	2	-	-	-	-	-	-	2	-	-	-	-	-
CO 3	3	3	2	-	-	-	-	-	-	2	-	-	-	-	-
CO 4	3	3	2	-	-	-	-	-	1	2	-	-	-	-	-
CO 5	3	3	2	-	-	-	-	-	1	2	-	-	-	-	-
CO 6	3	3	2	-	-	-	-	-	1	2	-	-	-	-	-

20OE608	AUTOMOTIVE ELECTRICAL AND ELECTRONICS SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the need for alternator in the vehicle.
- To understand the need for storage batteries and starter motor
- To explain the different types of electronic ignition systems
- To list common types of sensor and actuators used in vehicles.
- To explain the different safety systems used in vehicles.

PRE-REQUISITE: NIL

UNIT-I CHARGING SYSTEM, LIGHTING SYSTEM AND ACCESSORIES SYSTEM **9**

Introduction about electrical and electronics in automobiles. DC Generators and Alternators their characteristics.Voltage and Current Regulation, Cut –out relays and regulators Control unit – electronic regulators.Vehicle interior and exterior lighting systems. Wiring requirements, lighting design. Dashboard instruments - (fog lamps, auxiliary lighting, temperature gauge, oil pressure gauge, fuel gauge, speedometer, odometer, horn, windscreen wiper signaling devices and trafficator)

UNIT-II BATTERIES AND STARTING **9**

Types of Batteries – principle, rating, testing and charging, new developments in electrical storage batteries. Starter motors characteristics, principle and construction of starter motor, drive mechanisms, capacity requirements, servicing and trouble shooting, starter switches and solenoids.

UNIT - III ELECTRONIC IGNITION AND INJECTION SYSTEM **9**

Conventional ignition system and its components, Electronic, Programmed, Distributor less and direct injection systems, spark advance and retard mechanisms. Types of spark plugs.Types of fuel injection in Petrol and Diesel engines.

UNIT – IV SENSORS, CONTROLLER AND ACTUATORS **9**

Types of sensors – Vehicle speed sensor, Oxygen sensor (Lambda sensor), pressure sensor, Hot wire anemometer sensor, Knock sensor, Throttle position sensor, Crank position sensor. Electronic Control Module (ECM).Types of actuators- Exhaust gas recirculation, idle speed, ignition controller, (SI Engines), Injection control and ABS actuator. Applications - Keyless entry system, Electronic suspension system, Electronic steering system.

UNIT – V SAFETY SYSTEMS **9**

Antilock braking system, Air bag restraint system, Voice warning system, Seat belt system, Road navigation system, Obstacle avoidance radar system, Alarms and immobilizer system.

TOTAL:45 PERIODS

TEXT BOOKS:

1. TOM Denton, —Automobile Electrical and Electronic Systems, 3rd Edition, Elsevier Butterworth – Heinemann Publications, 2004.
2. William B. Ribbens, — Understanding Automotive Electronics, 5th Edition, Butterworth –Heinemann Publications, 1998.
3. Kholi .P.L. Automotive Electrical Equipment,Tata McGraw-Hill co ltd, New Delhi,2004

REFERENCES:

1. Judge A.W., —Modern Electrical Equipment of Automobiles: Motor Manuals Volume Six, 2nd Edition, Springer Science & Business Media, 2012.
2. Robert Bosch GmbH, —Automotive Hand Book, 9th Edition, Wiley, 2014. 2004.
3. AdityaP.Mathur, —Introduction to Microprocessors, 3rd Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1989.

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : **AUTOMOTIVE ELECTRICAL AND ELECTRONICS SYSTEMS**		Course Code : **20OE608**			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CO 1	Explain the working of charging, lighting and miscellaneous systems involved in automobiles.	1	K2	1,2,3,4,9	-
CO 2	Explain the battery types and components involved in starting system.	2	K2	1,2,3,4,10	-
CO 3	Differentiate the different wiring and lighting systems.	2	K2	1,2,3,4,9	-
CO 4	Describe the types of ignition and injection systems of IC engine.	3	K2	1,2,3,4,9	-
CO 5	Determine the function and operation of sensors and actuators and have a good knowledge of how they are used in the management of the vehicle control.	4	K2	1,2,3,4,10	-
CO 6	Identify the various safety systems of automobiles and their working.	6	K2	1,2,3,4,9	-

CO – PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2	2	1	-	-	-	-	2	-	-	-	-	-	-
CO 2	3	2	2	1	-	-	-	-	-	2	-	-	-	-	-
CO 3	3	2	2	1	-	-	-	-	2	-	-	-	-	-	-
CO 4	3	2	2	1	-	-	-	-	2	-	-	-	-	-	-
CO 5	3	2	2	1	-	-	-	-	-	2	-	-	-	-	-
CO 6	3	2	2	1	-	-	-	-	1	-	-	-	-	-	-