NOIDA INSTITUTE OF ENGINEERING & TECHNOLOGY, GREATER NOIDA, GAUTAM BUDDH NAGAR (AN AUTONOMOUS INSTITUTE)

Affiliated to

DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY UTTAR PRADESH, LUCKNOW

Evaluation Scheme & Syllabus

For

Minor Degree / Specialization

in

E-mobility

School of Mechanical Engineering

(Effective from the Session: 2022-23)

NOIDA INSTITUTE OF ENGG. & TECHNOLOGY, GREATER NOIDA, GAUTAM BUDDH NAGAR
(AN AUTONOMOUS INSTITUTE)

Minor Degree / Specialization
E-mobility

EVALUATION SCHEME

Sl. No.	Subject Codes	Subject Name	Period			Evaluation Scheme				End Semester		Total	Credit	Sem
			L	T	P	AA	QZ	TOTAL	PS	TE	PE			
1	AMSEM0301	Modern Automotive Technology	3	0	0	25	25	50		100		150	3	III
2	AMSEM0401	Green Transportation Systems	3	0	0	25	25	50		100		150	3	IV
3	AMSEM0501	Smart vehicles	3	0	0	25	25	50		100		150	3	V
4	AMSEM0601	Power drives and systems	3	0	0	25	25	50		100		150	3	VI
5	AMSEM0701	Automotive Power Grids	3	0	0	25	25	50		100		150	3	VII
6	AMSEM0351	Modern Automotive Technology Lab	0	0	2				25		25	50	1	III
7	AMSEM0451	Green Transportation Systems Lab	0	0	2				25		25	50	1	IV
8	AMSEM0551	Power drives and systems Lab	0	0	2				25		25	50	1	V
9	AMSEM0751	Capstone Project	0	0	2				50		50	100	2	VII
		GRAND TOTAL										1000	20	

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Branch wise Minor Degree / Specialization Details

S.no.	Name of Minor Degree/Specialization	Streams/Branches of B.Tech. Programs whose students are eligible to opt for the Minor Degree	Streams/Branches of B.Tech. Programs whose students are eligible to opt for the Specialization
1	Artificial Intelligence and Machine Learning	All Branches except CSE and EC related Branches	CSE and EC related Branches
2	Data Science	All Branches except CSE and EC related Branches	CSE and EC related Branches
3	E-mobility	All Branches except ME related Branches	Only ME Branch
4	VLSI Design	All Branches except EC related Branches	Only EC Branch

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Guidelines for assessment of Minor Degree / Specialization Program

For Theory Paper

Internal (50)		External (100)
ASSIGNMENT (25)	**QUIZ(25)**	
5 Assignments of 5 marks each	5 Quiz papers of 5 marks each	Theory Examination will be Conduct at the end of Semester

For Practical Paper

Internal (25)	External (25)
On the basis of continuous Assessment	Practical Examination will be Conduct at the end of Semester

Course Code	AMSEM0301	L	T	P	Credit
Course Title	Modern Automotive Technology	3	0	0	3

Course objective:

1. To understand Modern vehicles.
2. To know about basics of Modern vehicles Technologies.
3. To understand Energy Management.
4. To describe about Power Transmission & Control.
5. To elaborate various Safety & Emission Norms.

Pre-requisites: Physics, Basic Electrical concepts, Basic Electronics

Course Contents / Syllabus

UNIT-I	Introduction	8 hours

Introduction and need of modern technologies; Components of mechanical module in modern vehicles; Engine management system**.**

UNIT-II	Modern vehicles Technologies	8 hours

Working Principle of Hybrid Electrical Vehicles technologies, Fuel Cell technology, Full Electric vehicles and types, solar power vehicles.

UNIT-III	Energy Management	8 hours

Batteries; Electric machines Electric motors; Components of electrical & electronics module; energy consumption & efficiency.

UNIT-IV	Power Transmission & Control	8 hours

Vehicle system module; Braking system; ABS components and Operations, power steering, suspension systems, Clutch and differential gear box

UNIT-V	Safety & Emission Norms	8 hours

Emissions control techniques, Indian emissions standards and regulations, Safety measures; Diagnostic system for modern vehicles.

Course outcome:

CO 1	Understand the basic concepts of various systems used in automobile.	k2
CO 2	Understand the modern vehicle technologies and distinct types of vehicles.	k2
CO 3	Understand the principles and fundamentals of automotive electrical system and study their functions.	k2
CO 4	Understand the braking system and power transmission system- types & constructional features used in automobile.	k2
CO 5	Describe the principles and architecture of power and drive train and its components present in an automobile	k2

Text books :

1. “Modern Automotive Technology” by James E. Duffy
2. “Automobile Engineering”, Dr. Kripal Singh.
3. “Automobile Engineering”, R.B. Gupta, Satya Prakasan.
4. “Automobile Engineering”, R.K. Rajput, Laxmi Publications (P) Ltd.

Reference Books:

1. Heldt P. M., "Automotive chassis", Chilton Co., New York.
2. Giles J.G., "Steering, Suspension and Tyres", Iliffe Book Co., London.
3. Heinz Heisler, “Advance vehicle Technology”, Butterworth-Heinemann, 2002.

4. Newton and Steeds, “Motor vehicles”, Life Publishers, 1985.	
5. Crouse, W.H., Anglin, D.L.,” Automotive Transmission and Power Trains construction”, McGraw Hill,	
Link: NPTEL/ YouTube/ Faculty Video Link:	
Unit 1	https://www.youtube.com/watch?v=xCPINg7s1yY
Unit 2	https://www.youtube.com/watch?v=D-f0yVjYBRQ
Unit 3	https://www.youtube.com/watch?v=GeSY3oHHGAU
Unit 4	https://www.youtube.com/watch?v=uy9lZCdkQIM&list=PLD4ED2FAF3C155625
Unit 5	https://www.youtube.com/watch?v=HBPtdm9lErI

Course Code	AMSEM0401	L	T	P	Credit
Course Title	Green Transportation Systems	3	0	0	3

Course objective:

1. To understand Green Transportation Systems.
2. To know about basics of Modern Transport Planning
3. To understand Various Transportation Models
4. To describe about Transportation Strategies.
5. To elaborate various Green Transportation Infrastructures.

Pre-requisites:

Course Contents / Syllabus

UNIT-I	Introduction	8 hours

Green Transportation: Introduction to Environmental Impact Assessment (EIA) and Transportation systems; Land-use plans, zoning schemes and provisions.

UNIT-II	Modern Transport Planning	8 hours

Urban and regional transport planning Impacts on humans, flora and fauna, soil, water, air, climate and landscape, Airplanes, Railways, Metro, Ropeway, Tramways, Crane, Earth movers, Tractors, Commercial, Trucks & Buses.

UNIT-III	Various Transportation Models	8 hours

Establishment of baseline conditions w.r.t soil, water and air quality; noise, air and water pollution modelling, Shipping, Bullet Trains, Magnetic Lavigation, Hyperloops.

UNIT-IV	Transportation Strategies	8 hours

Modelling of impacts and scenario-based analysis; Assessment of potential project impacts including indirect, cumulative and synergistic impacts, Autonomous Vehicles, AI & ML applications, Fog security Systems.

UNIT-V	Green Transportation Infrastructures	8 hours

Decision support systems for EIA of transport infrastructures; Abatement measures; Sustainable transportation systems, Hydrogen Fuel, Fuel Cells.

Course outcome:

CO 1	Understand the current transport systems, their sustainability consequences, and how they can be transformed strategically to sustainability.	K2
CO 2	Describe in an overall way global sustainability challenges, policies and objectives that affect the development potential of the transport sector.	K2
CO 3	Describe current and possible future passenger and goods transport modes and their life cycles, and how they relate to strategic sustainable development	K2
CO 4	Describe current and possible future transport planning as a part of spatial planning for urban and rural development, transport management/governance, integration of different transport modes, and how they relate to strategic sustainable development.	K2
CO 5	Understand the various transportation strategies	K2

Text books :

1. Assessment & Decision Making for Sustainable Transport, European Conference of Ministers of Transport, OECD Publishing 2004.

2. Wood, C. and Wood, C., "Environmental Impact Assessment: A Comparative Review", Prentice Hall. 2002.

3. Petts, J., "Handbook of Environmental Impact Assessment", Blackwell Publishing. 1999

Reference Books:	
1. Sucharov, L.J. and Baldasano, J.M., "Urban Transport and the Environment, Vol. II", Computational Mechanics Publications. 1996.	
2. Zannetti P. (Ed.), "Environmental Modeling, Vol. I", Computational Mechanics Publication, Elsevier Applied Science. 1993.	
3. Tumlin, Jeffrey (2012). Sustainable Transportation Planning: Tools for Creating Vibrant, Healthy and Resilient Communities. Wiley, Hoboken, NJ.	
Link: NPTEL/ YouTube/ Faculty Video Link:	
Unit 1	https://www.youtube.com/watch?v=2M8FZiKQ798
Unit 2	https://www.youtube.com/watch?v=OnjX0O9dPMc
Unit 3	https://www.youtube.com/watch?v=NwgjVFjmlws
Unit 4	https://www.youtube.com/watch?v=GJiaIcYuAlQ
Unit 5	https://www.youtube.com/watch?v=yDz5bRy7AgI

Course Code	AMSEM0501	L	T	P	Credit
Course Title	Smart vehicles	3	0	0	3

Course objective:

1. To understand Automated, Connected, and Intelligent Vehicles.
2. To know about basics of Remote Sensing and Wireless Technology.
3. To understand Wireless Networking and Connected Car Technology.
4. To describe about Vehicle Prognostics Technology and Autonomous Vehicles.
5. To elaborate various Troubleshooting and Maintenance of ADAS Systems.

Pre-requisites: Physics, Basic Electrical concepts, Basic Electronics

Course Contents / Syllabus

UNIT-I **Introduction to Automated, Connected, and Intelligent Vehicles** **8 hours**

Automotive Electronics, Infotainment, Body, Chassis, and Power Train Electronics, Advanced Driver Assisted Systems, Basic Control System Theory, Overview of ECU operation, Concept of Cyber-Physical Control Systems, Remote Sensing Technology, Wireless Networks and Autonomy.

UNIT-II **Remote Sensing and Wireless Technology** **10 hours**

Radar & Sonar, LIDAR – Multiple Beam, Cameras & Night Vision, Model Creation & Sensor Data Fusion, Wireless System Block Diagram, Transmission - Modulation/Encoding, Reception - Demodulation/ Decoding, Propagation, Transmission Lines, and Antennas, World-Wide Standards, Cellular and IEEE, Examples: DSRC, VANET, IEEE 802.11p.

UNIT-III **Wireless Networking and Connected Car Technology** **8 hours**

Basic Networking Concepts, Wireless Networking Fundamentals, IEEE802.11, 802.15, 802.16, and Cellular, Protocols and IP Addressing, Connection of On-Board Networks to Off Board, Review of On-Board Networks, Connectivity Fundamentals, Navigation and Other Applications, Vehicle-to-Vehicle (V2V), Vehicle-to-Roadside (V2R), Vehicle-to-Infrastructure (V2I), Wireless Security Issue.

UNIT-IV **Vehicle Prognostics Technology and Autonomous Vehicles** **8 hours**

Monitoring of Vehicle Systems – Advanced OBD, Basic Maintenance Functions, End-of-Life Predictions, ADAS Maintenance, Driverless Vehicle Technology, Artificial Intelligence and Deep Learning, Implementation Issues.

UNIT-V **Troubleshooting and Maintenance of ADAS Systems** **8 hours**

Failure Modes and Self Calibration, Sensor Testing and Calibration, Redundant Systems, Software Upgrades, Uber/Lyft Business Model, Trucking, Farming, Mining, Shipping and Rail, Military.

Course outcome:

CO 1	Analyze the Automated, Connected, and Intelligent Vehicles.	K1, K2
CO 2	Evaluate Remote Sensing and Wireless Technology models.	K3, K4
CO 3	Explain the use of different Remote Sensing and Wireless Technologies.	K2, K3

CO 4	Analyze Vehicle Prognostics Technology and Autonomous Vehicles systems.	K3, K4
CO 5	Relevant Troubleshooting and Maintenance of ADAS Systems.	K2, K3

Text books :

1. Ljubo Vlacic, Michel Parent, Fumio Harashima, "Intelligent Vehicle Technologies Theory and Applications" Boca Raton, CRC Press, 2001

2. Husain, I. "Electric and Hybrid Vehicles" Boca Raton, CRC Press, 2010.

3.Stuart Borlase 'Smart Grid: Infrastructure, Technology and Solutions', CRC Press 2012.

Reference Books:

1. G. Mullett, Wireless Telecommunications Systems and Networks, Thomson – Delmar Learning, ISNB#1-4018-8659-0, 2006

Link: NPTEL/ YouTube/ Faculty Video Link:

Unit 1	https://www.youtube.com/watch?v=HgF7E5q9sU4
Unit 2	https://www.youtube.com/watch?v=N49PzLDUIFQ
Unit 3	https://www.youtube.com/watch?v=0FXHr1B8H7M
Unit 4	https://www.youtube.com/watch?v=gEy91PGGLR0
Unit 5	https://www.youtube.com/watch?v=EiWl5PAtfYA

Course Code	AMSEM0601	L	T	P	Credit
Course Title	Power drives and systems	3	0	0	3

Course objective:

1. To understand Automated, Connected, and Intelligent Vehicles.
2. To know about basics of Remote Sensing and Wireless Technology.
3. To understand Wireless Networking and Connected Car Technology.
4. To describe about Vehicle Prognostics Technology and Autonomous Vehicles.
5. To elaborate various Troubleshooting and Maintenance of ADAS Systems.

Pre-requisites: Physics, Basic Electrical concepts, Basic Electronics

Course Contents / Syllabus

UNIT-I	Introduction	8 hours

Power Drives: Dynamics of Electric Drives: Fundamentals of torque equation, Speed torque convention and multi-quadrant operation, components of load torques

UNIT-II	Power Drive Classifications	8 hours

Classification of load torques steady state stability. Load equation, Speed control and drive classification and close loop control of drives.

UNIT-III	Various Power Drives	8 hours

DC motor Drives-Modelling of DC machines. Steady state characteristics with armature and speed control, Phase controlled DC motor drives, Chopper controlled DC motor drives.

UNIT-IV	Various Power Drive Control Systems	8 hours

Poly-phase induction machines- Dynamic modelling of induction machines. Small signal equations, control characteristics of induction machines. Phase-controlled induction machines, Stator voltage control, Slip energy recovery scheme, frequency control and vector control of induction motor drives.

UNIT-V	Power Machines	8 hours

Traction motor: Starting, Speed-Time characteristics, Braking, Traction motors used in practice. Industrial Drives-Digital Control of Electric Drives, Stepper motor, Servo motor, Solar drive, BLDC drive, PMSM drive, SRM drive and their specific applications.

Course outcome:

CO 1	Model and simulate electric drive systems	K2
CO 2	Design modulation strategies of power electronics converters, for drives application	K2
CO 3	Design appropriate current/voltage regulators for electric drives	K2
CO 4	Select and implement the drives for Industrial Process	K2
CO 5	Implement various variable speed drives in Electrical Energy Conversion System	K2

Text books :

1. G.K, Dubey, "Power semiconductor controlled Drives", Prentice Hall international, New Jersey, 1989.
2. R.Krishanam, “Electric motor drives modeling, analysis and control”, PHI-India-2009
3. G. K. Dubey,“Fundamentals of electric Drives, Narosa Publishing House”, 2nd edition, 2011.

Reference Books:

1. W. Leonhard, “Control of Electrical drives”, Springer, 3rd edition, 2001.
2. P.C. Krause –, “Analysis of Electric Machine”, Wiley-IEEE press 3rdedition.
3. K. Bose,“Modern Power Electronics and AC Drives”, Prentice Hall publication, 1st edition, 2001.

Link: NPTEL/ YouTube/ Faculty Video Link:	
Unit 1	https://www.youtube.com/watch?v=btNSMMednG0
Unit 2	https://www.youtube.com/watch?v=E8f_h_6DIZc
Unit 3	https://www.youtube.com/watch?v=EaENkSSUK-k
Unit 4	https://www.youtube.com/watch?v=1AT1yuQ9awM&list=PLFW6lRTa1g83sIfVY1p1xGqPGYUmXyahx
Unit 5	https://www.youtube.com/watch?v=L6bq5U9tVt0

Course Code	AMSEM0701	L	T	P	Credit
Course Title	Automotive Power Grids	3	0	0	3

Course objective:

1. To understand hybrid electric vehicle
2. To know about basics of electric drives
3. To understand concept of energy storage
4. To describe about Energy management systems
5. To elaborate various Mobility and connectors

Pre-requisites: Physics, Basic Electrical concepts, Basic Electronics

Course Contents / Syllabus

UNIT-I	Introduction to Hybrid Electric Vehicle	8 hours

Review of Conventional Vehicle: Introduction to Hybrid Electric Vehicles: Types of EVs, Hybrid Electric Drivetrain, Tractive effort in normal driving

UNIT-II	Electric Drives	10 hours

Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive trains, Electric Propulsion unit, Configuration and control of DC Motor drives, Induction Motor drives, Permanent Magnet Motor drives, switched reluctance motor.

UNIT-III	Energy Storage	8 hours

Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles: - Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive system, Design of Hybrid Electric Vehicle and Plug-in Electric Vehicle.

UNIT-IV	Energy Management System	8 hours

Energy Management Strategies, Automotive networking and communication, EV charging standards, V2G, G2V, V2B, V2H. Business: E-mobility business, electrification challenges, Business- E-mobility business, electrification challenges.

UNIT-V	Mobility and Connectors	8 hours

Connected Mobility and Autonomous Mobility- case study E-mobility Indian Roadmap Perspective. Policy: EVs in infrastructure system, integration of EVs in smart grid, social dimensions of EVs. Connectors- Types of EV charging connector, North American EV Plug Standards, DC Fast Charge EV Plug Standards in North America, CCS (Combined Charging System), CHAdeMO, Tesla, European EV Plug Standards,

Course outcome:

CO 1	Analyze the grid system in hybrid electric Vehicles.	K_1, K_2
CO 2	Evaluate concept of electric drives	K_3, K_4
CO 3	Explain the use of different energy storages	K_2, K_3
CO 4	Analyze Vehicle energy management systems	K_3, K_4
CO 5	Relevant mobility and connectors.	K_2, K_3

Text books :

1. Emadi, A. (Ed.), Miller, J., Ehsani, M., "Vehicular Electric Power Systems" Boca Raton, CRC Press, 2003

2. Husain, I. "Electric and Hybrid Vehicles" Boca Raton, CRC Press, 2010.

3. Tariq Muneer and Irene IllescasGarcía, "The automobile, In Electric Vehicles: Prospects and Challenges", Elsevier, 2017

Reference Books:	
1. Larminie, James, and John Lowry, "Electric Vehicle Technology Explained" John Wiley and Sons, 2012	
2. Sheldon S. Williamson, "Energy Management Strategies for Electric and Plug-in Hybrid	
3. Electric Vehicles", Springer, 2013	
Link: NPTEL/ YouTube/ Faculty Video Link:	
Unit 1	https://www.youtube.com/watch?v=opvKyJ3DVJI
Unit 2	https://www.youtube.com/watch?v=1AT1yuQ9awM&list=PLFW6lRTa1g83sIfVY1p1xGqPGYUmXyahx
Unit 3	https://www.youtube.com/watch?v=9eAFEU7pMwU
Unit 4	https://www.youtube.com/watch?v=JABjhJHX8Tc
Unit 5	https://www.youtube.com/watch?v=ASU5nT3cTfs

Course Code	AMSEM0351	L	T	P	Credit
Course Title	Modern Automotive Technology Lab	0	0	2	1

Course objective:

Students will be studying the experiments based on Modern Automotive Technology systems

Pre-requisites: Student know the concept of Automobiles and systems.

Suggested list of Experiment Perform Ten experiment from the list of Experiment

S. No.	Name of Experiments
1	To Study Engine control units in modern Automobile systems
2	To Study Engine management techniques
3	To Study Engine cooling system of modern vehicles
4	To Study hybrid electric vehicle
5	To Study fuel cell technology
6	To Study solar power vehicles
7	To Study electric motors
8	To Study energy consumption and efficiency
9	Draw a flowchart of ABS components
10	To Study manual clutch and gear box
11	To Study power steering
12	To Study suspension systems

Course outcome:

CO 1	Understand the concept of Engine control	K2
CO 2	Understand the concept of Engine management	K2
CO 3	Understand the concept of Engine cooling system	K2
CO 4	Understand the concept of fuel cell technology	K2
CO 5	Understand the concept of electric motors	K2

Link: NPTEL/ YouTube/ Faculty Video Link:

1.	https://www.youtube.com/watch?v=dxv579W2G2c
2.	https://www.youtube.com/watch?v=HgwhvfKcMMw

Course Code	AMSEM0451	L	T	P	Credit
Course Title	Green Transportation Systems Lab	0	0	2	1

Course objective:

Students will be studying the experiments based on Green Transportation Systems.

Pre-requisites: Student know the concept of Automobiles and systems

Suggested list of Experiment Perform Ten experiment from the list of Experiment

S. No.	Name of Experiments
1	To Study Environmental Impact Assessment (EIA) model for automobiles.
2	To Study Land-use plans, zoning schemes.
3	To Study Urban and regional transport planning Impacts on humans
4	To Study Urban and regional transport planning Impacts on Trucks & Buses
5	To Study Establishment of baseline conditions w.r.t soil, water and air quality.
6	To Study Magnetic Levitation.
7	To Study Bullet Trains model.
8	To Study Modelling of impacts and scenario-based analysis.
9	To Study Assessment of potential project impacts
10	To Study Fog security Systems
11	To Study Sustainable transportation systems
12	To Study Decision support systems for EIA of transport infrastructures.

Course outcome:

CO 1	Understand the concept of Land-use plans, zoning schemes	K2
CO 2	Understand the concept of Environmental Impact Assessment (EIA) model for automobiles	K2
CO 3	Understand the concept of Magnetic Levitation.	K2
CO 4	Understand the concept of Bullet Trains model.	K2
CO 5	Understand the concept of Fog security Systems	K2

Link: NPTEL/ YouTube/ Faculty Video Link:

1.	https://www.youtube.com/watch?v=yDz5bRy7AgI
2.	https://www.youtube.com/watch?v=pBwemNvHVkY

Course Code	AMSEM0551	L	T	P	Credit
Course Title	Power drives and systems Lab	0	0	2	1

Course objective:

Students will be studying the experiments based on Power drives and systems

Pre-requisites: Student know the concept of Automobiles and systems

Suggested list of Experiment Perform Ten experiment from the list of Experiment

S. No.	Name of Experiments
1	To Study 1-phase Half & Full Controlled Converter.
2	To study Characteristics of 1-phase Cycloconverter
3	To study the construction of a three-phase induction motor with the help of a model.
4	To study about the starters of three phase induction motors
5	To study about the power modulator & control unit.
6	To perform the Speed control of DC shunt Motor by Armature control.
7	To Start DC shunt motor by using three-point starter
8	To obtain the Speed control of DC shunt Motor by Field control.
9	To study about the detailed structure of wind power station
10	To study about Traction motor: Starting, Speed-Time characteristics
11	To study about Poly-phase induction machines
12	To study about Chopper controlled DC motor drives

Course outcome:

CO 1	Understand the concept of Full Controlled Converter	K2
CO 2	Understand the concept of Characteristics of 1-phase Cycloconverter	K2
CO 3	Understand the concept of Traction motor: Starting, Speed-Time characteristics	K2
CO 4	Understand the concept of Poly-phase induction machines	K2
CO 5	Understand the concept of Chopper controlled DC motor drives	K2

Link: NPTEL/ YouTube/ Faculty Video Link:

1.	https://www.youtube.com/watch?v=mPJxo_RnlFE
2	https://www.youtube.com/watch?v=DBvCP-LL-mE