

**UNIVERSITY POLYTECHNIC
BIRLA INSTITUTE OF TECHNOLOGY MESRA – 835215 (RANCHI)**

DEPARTMENT OF AUTOMOBILE ENGINEERING

VI Semester

NEW COURSE STRUCTURE – To be effective for Diploma 2023-24 [3 rd Year Onwards] Based on CBCS system & OBE model Recommended scheme of study for Diploma in Automobile Engineering							
Semester of Study	Category of Course	Course Code	Subjects	Mode of delivery			Credits
				L	T	P	C
SIXTH	THEORY						
	Program Core	DAE601	Electric Vehicles	3	0	0	3
		DAE603	Automotive Emission and Control System	3	0	0	3
	Program Elective	PE-IV: DPE 611/ DPE 652/ DPE 653		3	0	0	3
	Humanities and Social Sc.	DHS 601	Entrepreneurship and Start-ups	3	1	0	4
	Open Elective	OE-III: DOE 612/ DOE 613		3	0	0	3
	Mandatory Course	DAU 601	Indian Constitution	3	0	0	0
	SESSIONAL						
	Program Core	DAE 612	Automotive Repair and Maintenance Lab -II	0	0	2	1
	Seminar	DSE612	Seminar	0	0	1	1
	Major Project	DPR612	Project - II	0	0	6	3
	TOTAL CREDITS			18	0	9	21
		Total Lectures Per Week			27		
	GRAND TOTAL FOR THIRD YEAR						

DEPARTMENT OF AUTOMOBILE ENGINEERING

PROGRAMME ELECTIVES (PE)

PE-IV							
SEM- VI	DPE 611	Vehicles Aero dynamics		3	0	0	3
	DPE 652	Industrial & production management		3	0	0	3
	DPE 653	Operation Research		3	0	0	3

OPEN ELECTIVES (OE)*

SEMESTER	Code no.	Name of the PE courses	Prerequisite/ Co-requisite courses with code	L	T	P	C
OE-III							
SEM- VI	DOE 612	Motor Vehicle Technology		3	0	0	3
	DOE 613	Electric Vehicles		3	0	0	3
*OPEN ELECTIVES TO BE OPTED ONLY BY OTHER DEPARTMENT STUDENTS							

*OPEN ELECTIVES TO BE OPTED ONLY BY OTHER DEPARTMENT STUDENTS

UNIVERSITY POLYTECHNIC
B.I.T., MESRA – 835215 (RANCHI)
SYLLABUS (CBCS)-2023
COURSE: ELECTRIC VEHICLE

PROGRAMME: DIPLOMA							
COURSE CODE: DAE 601				Course Title: Electric Vehicle			
COMPULSARY / OPTIONAL: COMPULSARY							
Teaching Scheme and Credits					EXAMINATION SCHEME		
L	T	P	HOUR/WEEK	CREDIT	PE	FINAL	TOTAL
3	0	0	3	3	50	50	100

COURSE OBJECTIVE: This course envisions imparting the students to

1	Learn the environmental impact and history of Electric Vehicles and types of Electric vehicles.
2	Understand and test the concept of EV drive Trains.
3	Describe the configurations of storage system.
4	Familiarisation of Manual and Automatic converter systems.
5	Summarize the E-Mobility and Indian EV Policy.

COURSE OUTCOME: After the completion of this course, students will be able to

CO1	Understand history & importance of Electrical Vehicles.
CO2	Understand working of various Electric Drive Trains.
CO3	Enlist and understand various storage requirements for electric vehicles.
CO4	Understand operation of various types of converters.
CO5	Check ongoing scenario at world and national level in Electric vehicle market.

COURSE CONTENT DETAILS:

Module	Topic/ Subtopic
1	History & Importance of Electrical Vehicles 1.1 History of Electric Vehicles, Development towards the 21st Century, 1.2 Types of Electric Vehicles in use today – Battery Electric Vehicle, 1.3 Hybrid (ICE & others), Fuel Cell EV, Solar Powered Vehicles. 1.4 Social and environmental importance of hybrid and electric vehicles, 1.5 impact of modern drive-trains on energy supplies. CO1 Teaching Hours:8 hrs
2	Electric Drive Trains 2.1 Basic concept of electric traction, 2.2 introduction to various electric drive- train topologies, 2.3 power flow control in electric drive-train topologies, fuel efficiency analysis. 2.4 Electric Propulsion unit: Introduction to electric components used in

	hybrid and electric vehicles, 2.5 Configuration and control of DC Motor drives, 2.6 C configuration and control of Induction Motor drives, configuration and control of Permanent Magnet 2.7 Motor drives, Configuration and control of Switched Reluctance Motor drives, drive system efficiency. CO2 Teaching Hours:8 hrs
3	Storage Systems 3.1 Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, 3.2 Battery based energy storage and its analysis, 3.3 Fuel Cell based energy storage and its analysis, 3.4 Super Capacitor based energy storage and its analysis, 3.5 Flywheel based energy storage and its analysis, 3.6 Hybridization of different energy storage devices. CO3 Teaching Hours:8 hrs
4	Converters 4.1 Introduction to AC/DC, DC/AC, AC/AC, DC/DC converters, 4.2 four quadrant operation of converters CO4 Teaching Hours:8 hrs
5	Indian & Global Scenarios in Electric Vehicles 5.1 Technology Scenario, Market Scenario, 5.2 Policies & Regulations, 5.3 Payback & Commercial Model, Policies in India CO5 Teaching Hours:8 hrs

Text Book:

- 1.1. A.K Babu, Electric & Hybrid Vehicle, Second edition, Khanna Publication, 2022.
2. James D. Halderman, Electric and Hybrid Electric Vehicles, First edition Pearson, 2023.

REFERENCE BOOKS:

S.No	Title	Author, Publisher, Edition and Year of publication	ISBN
1	Electrical Vehicle Technology	Prof. Sunil R. Pawar	1685545610
2	Fundamentals of Hybrid and Electric Vehicles	Prof. K.C.Jain	9392549768

E REFERENCE:

1. <https://nptel.ac.in/courses/112103019/>
2. <https://www.tandfonline.com/>
3. Web links and Video Lectures (e-Resources): E-book URL:<https://www.pdfdrive.com/non-conventional-energy-sources-e10086374.html>

TEACHING METHODOLOGY:

Course Delivery Methods	TEACHING METHODOLOGY	
CD1	Lecture by use of boards/LCD projectors	√
CD2	Tutorials/Assignments	√
CD3	Seminars	√
CD4	Industrial/guest lectures	
CD5	Self- learning such as use of NPTEL materials and internet	√

Mapping of Course Outcomes onto Program Outcomes

	PO1	PO2	P3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	2	2	2	2	3
CO2	2	2	2	2	2	2	2	2	2	3
CO3	2	3	3	2	2	2	1	2	2	3
CO4	3	1	1	2	2	2	2	2	2	3
CO5	3	3	2	2	2	2	2	3	2	3

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SYLLABUS (CBCS)-2023

COURSE: AUTOMOTIVE EMISSION AND CONTROL SYSTEM

PROGRAMME: DIPLOMA							
COURSE CODE: DAE 603			Course Title: Automotive Emission and Control System				
COMPULSARY / OPTIONAL: COMPULSARY							
Teaching Scheme and Credits					EXAMINATION SCHEME		
L	T	P	HOUR/WEEK	CREDIT	PE	FINAL	TOTAL
3	0	0	3	3	50	50	100

COURSE OBJECTIVE: This course envisions imparting the students to

1	This course will provide an opportunity to develop skills in measuring pollution and maintain emission control devices. it is an important
2	Use appropriate Emission Control Device & Systems as per country prevailing emission-norms.
3	Test and analyses various Emission Control Devices to reduce air pollutant.
4	Select suitable alternative fuels for controlling pollution.
5	The course content should be taught and with the aim to develop different types of skills so that students are able to acquire following competencies

COURSE OUTCOME: After the completion of this course, students will be able to

CO1	Students develop skills in measuring pollution and maintain emission control devices.
CO2	To know the A/F ratio in engine, and find the percentage of different gasses in the exhaust gas.
CO3	To know the different process to control system of the emission gas.
CO4	To analyse the exhaust gas and their concentrations.
CO5	To the LPG, CNG gasses uses in Automobile vehicle.

COURSE DETAIL:

Module	Topic/Sub Topic
1	Introduction to automotive pollution The atmosphere: 1.1 Air pollutants, 1.2 pollutants produced by automobiles, 1.3 Emission control Norms- International and Indian Norms: Bharat standards, 1.4 Noise and sound pressure, 1.5 Measurement of Noise, causes of automobile noise and its reduction CO1 Teaching hr.: 8hr

2	Principle of production of exhaust gases 2.1 Describe various pollutants produced under different driving conditions, 2.2 Theoretical air-fuel ratio, 2.3 carbon mono-oxide (CO) Gas, Hydro-carbon (HC) Gas, oxides of Nitrogen (NO _x), 2.4 Driving conditions and Exhaust gases. CO2 Teaching hr.: 8hr
3	Emission control systems 3.1 Describe various systems used for emission control, 3.2 Explain construction & working of different Emission control systems, 3.3 Emission control components layout and drawing. 3.4 Necessity and operation of Positive Crankcase Ventilation (PCV) system, 3.5 Necessity and operation of fuel evaporative emission control (EVAP) system for Carbureted & MPFI engines. 3.6 Necessity and operation of Throttle Positioner (TP) system & Throttle Positioner sensor, 3.7 Catalytic converters, Oxygen (O ₂) sensor. 3.8 Necessity and operation of High-Altitude Compensation (HAC) system, Manifold Absolute Pressure Sensor (MAPS). CO3 Teaching hr.:8hr
4	Principle methods of exhaust gas analysis 4.1 Describe method of measuring various pollutants: Measuring CO and CO ₂ concentrations, 4.2 Measuring HC concentrations, Measuring NO _x concentrations. 4.3 Prevalent Automotive emission control norms in India. 4.4 Construction & working of Exhaust Gas analyzer. 4.5 Construction & working of Diesel, Smoke meter. CO4 Teaching hr.: 8hr
5	LPG and CNG conversion 5.1 Describe conversion, installation & maintenance of LPG & CNG kit, 5.2 Merits of LPG's., LPG conversion kit, LPG kit installation. 5.3 Maintenance of LPG kit 5.4 Merits of CNG's., CNG conversion kit., CNG kit installation, Maintenance of CNG kit 5.5 Performance features of Petrol, LPG and CNG vis-à-vis. CO5 Teaching hr.: 8hr

TEXT BOOKS:

Anil Chhikara

Automobile Engineering

Richard K. Du Puy, Steven D. Schaefer, Fuel systems and emission controls

References Books

Tom Denton Automobile Electrical & Electronics System

E REFERENCE:

1. <https://nptel.ac.in/courses/112103019/>
2. <https://www.tandfonline.com/>
3. Web links and Video Lectures (e-Resources): E-book
URL: <https://www.pdfdrive.com/non-conventional-energy-sources-e10086374.html>

TEACHING METHODOLOGY:

Course Delivery Methods	TEACHING METHODOLOGY	
CD1	Lecture by use of boards/LCD projectors	√
CD2	Tutorials/Assignments	√
CD3	Seminars	√
CD4	Industrial/guest lectures	
CD5	Self- learning such as use of NPTEL materials and internet	√

Mapping of Course Outcomes onto Program Outcomes

	PO1	PO2	P3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO2
CO1	3	2	2	1	2	2	2	3	2	3
CO2	2	2	2	2	2	2	2	3	3	3
CO3	2	3	3	2	2	2	1	3	2	3
CO4	3	1	1	2	2	2	2	3	3	3
CO5	3	3	2	2	2	2	2	3	3	3

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SYLLABUS (CBCS)-2023

COURSE: AUTOMOBILE REPAIR AND MAINTENANCE LAB-II

Programme: Diploma							
Course Code: DAE 612			Course Title: Automobile Repair and Maintenance Lab-II				
COMPULSARY / OPTIONAL: COMPULSARY							
Teaching Scheme and Credits					EXAMINATION SCHEME		
L	T	P	HOUR/WEEK	CREDIT	PE	FINAL	TOTAL
0	0	2	2	1	60	40	100

COURSE OBJECTIVES: Students will be able to understand about

1	To understanding of different clutch systems.
2	Study and identifications of different gearboxes and their servicing.
3	To study different components of wheel, tyre and steering systems.
4	To Study different components of lighting systems.
5	Analyze the complete vehicle and their performance.

COURSE OUTCOME: Students will be able to understand about.

CO1	To understanding of different types of clutches, gearbox, shaft and their impact.
CO2	To understanding of different types of differentials and their impact.
CO3	To understanding of different types of wheels, tyres, brakes and their rotation & alignment.
CO4	To understanding of different types of lighting systems and their impact.
CO5	To perform complete servicing of any vehicles.

EXPERIMENTS

Sl. No.	Topic
1	Study and identifications of different types of Clutches and their adjustments.
2	Study and identifications of different types of Gearboxes and their adjustments.
3	Study and identifications of different types of Brakes and their adjustments, brake bleeding process.
4	Study and identifications of different types of shafts used in transmission system.
5	Perform wheel balancing and wheel alignment procedures.
6	Study and identifications of different types of steering systems.
7	Study and identifications of different types of differential systems.
8	Study and identifications of different types of Lighting system.
9	Perform complete servicing of any vehicles.
10	Perform vehicle testing.

TEXT BOOKS:

1. Crouse H. Willam | Anglin L. Donald. Automotive Mechanics
2. Gilles Tim. Automotive Service Inspection Maintenance Repair

REFERENCE BOOKS:

S.No	Title	Author, Publisher, Edition and Year of publication	ISBN
1	Automotive mechanics	Crouse h. Willam anglin l. Donald	0070992150
2	Automotive service inspecton maintenance repair	Gilles tim.	0827373546

E-REFERENCES:

1. <https://www.youtube.com/watch?v=o1ED4FQjDGk>
2. <https://www.youtube.com/watch?v=oNj1o4T7V3M>
3. <https://www.youtube.com/watch?v=nC6fsNXdcMQ>

TEACHING METHOLOGY

Course Delivery Methods	TEACHING METHOLOGY	
CD1	Lecture by use of boards/LCD projectors	√
CD2	Tutorials/Assignments	
CD3	Seminars	
CD4	Industrial/guest lectures	
CD5	Self- learning such as use of NPTEL materials and internet	√

Mapping of Course Outcomes onto Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	2	2	2	2	3
CO2	2	2	2	2	2	2	2	2	2	3
CO3	2	3	3	2	2	2	1	2	2	3
CO4	3	1	1	2	2	2	2	2	2	3
CO5	3	3	2	2	2	2	2	2	2	3

UNIVERSITY POLYTECHNIC
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SYLLABUS (CBCS)-2023
COURSE: VEHICLES AERODYNAMICS

PROGRAMME: DIPLOMA							
COURSE CODE: DPE 611			Course Title: Vehicles Aero dynamics				
COMPULSARY / OPTIONAL: OPTIONAL							
Teaching Scheme and Credits					EXAMINATION SCHEME		
L	T	P	HOURS/WEEEEK	CREDIT	PE	FINAL	TOTAL
3	0	0	3	0	50	50	100

COURSE OBJECTIVES: This course envisions imparting the students to

1.	To introduce the fundamental principles of aerodynamics and their application in vehicle design.
2.	To analyze aerodynamic drag and its impact on the performance and efficiency of automobiles.
3.	To study different types of aerodynamic drag and the methods to minimize them.
4.	To understand the concept of aerodynamic lift and its effect on vehicle stability.
5.	To explore vehicle aerodynamics, including body profiling, forces, and optimization techniques.

COURSE OUTCOMES: Students will be able to understand about

CO1	Explain fundamental aerodynamic forces, moments, and their influence on vehicle design.
CO2	Analyze the aerodynamic drag characteristics of cars and strategies to minimize them.
CO3	Identify different types of aerodynamic drag and their impact on vehicle motion.
CO4	Evaluate aerodynamic lift and its significance in vehicle stability and performance.
CO5	Apply principles of vehicle aerodynamics to optimize drag and improve efficiency.

COURSE CONTENT DETAILS:

MODULE	TOPICS/SUBTOPICS
1	INTRODUCTION TO AERODYNAMICS 1.1 Aerodynamic force and moments, lift and Drag coefficients, Centre of pressure and aerodynamic centre, 1.2 Coefficient of pressure, moment coefficient, Continuity and Momentum equations 1.3 Point source and sink, doublet, 1.4 Free and Forced Vortex, Uniform parallel flow, combination of basic flows, 1.5 Pressure and Velocity distributions on bodies Course Outcome: CO1 Teaching Hours: 8hrs

2	AERODYNAMIC DRAG OF CARS 2.1 Car as a bluff body, 2.2 Flow field around car –drag force –types of drag force 2.3 Analysis of aerodynamic 2.4 Drag coefficient of cars 2.5 Strategies for aerodynamic development low drag profiles 2.6 Pressure and Velocity distributions on bodies Course Outcome: CO2 Teaching Hours: 8 hrs
3	Aerodynamic drag: 3.1 pressure drag, 3.2 Air resistance opposing motion of a vehicle, equations, after flow wake, 3.3 Drag coefficients, various body shapes 3.4 Base drag, vortices 3.5 Trailing vortex drag, attached transverse vortices. Course Outcome: CO3 Teaching Hours: 8 hrs
4	Aerodynamic lift: - 4.1 Introduction, lift coefficients, vehicle lift, 4.2 Under body floor height versus aerodynamic lift and drag, 4.3 Aerofoil lift and drag, 4.4 Front end nose shape., 4.5 Aerodynamic study for heavy vehicles, Course Outcome: CO4 Teaching Hours: 8 hrs
5	Vehicle Aerodynamics: 5.1 Types of Chassis frames & body, aerodynamic consideration in body profiling. 5.2 Ergonomic consideration, defects in frame and body. 5.3 Vehicle drag and types, various types of forces and moments, 5.4 Effects of forces and moments, side wind, 5.5 Various body optimization techniques, and Aerodynamic Aids for Optimization of drag. Course Outcome: CO5 Teaching Hours: 8 hrs

REFERENCE BOOKS:

S. N.	Title	Author, Publisher, Edition and Year of publication	ISBN
1.	"Fundamentals of Vehicle dynamics", 1992	SAE USA, Thomas D. Gillespie	978-1-5609-1199-9
2.	Vehicle Dynamics	Martin Meywerk, Wiley	
3.	Vehicle Dynamics and Control: Advanced Methodologies	Shahram Azadi Reza Kazemi Hamidreza Rezaei Nedamani, Elsevier Science	978-0-323-85659-1

E REFERENCE:

1. <https://nptel.ac.in/courses/112103019/>
2. <https://www.tandfonline.com/>
3. Web links and Video Lectures (e-Resources): E-book
URL:<https://www.pdfdrive.com/non-conventional-energy-sources-e10086374.html>

Course Delivery methods	TEACHING METHODOLOGY	
CD1	Lecture by use of boards/LCD projectors	✓
CD2	Tutorials/Assignments	✓
CD3	Seminars	✓
CD4	Industrial/guest lectures	✓
CD5	Self- learning such as use of NPTEL materials and internet	✓

Mapping of Course Outcomes onto Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	1	1	1	2	3
CO2	2	3	3	2	3	1	1	0	2	3
CO3	2	3	3	2	3	1	1	2	2	3
CO4	2	2	3	3	3	2	2	2	2	3
CO5	2	3	2	2	2	2	3	2	1	3

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SYLLABUS (CBCS)-2023

Course: Industrial Engineering & Production Management

PROGRAMME: DIPLOMA							
COURSE CODE: DPE 652			Course Title: Industrial & Production Management				
COMPULSARY / OPTIONAL: OPTIONAL							
Teaching Scheme and Credits					EXAMINATION SCHEME		
L	T	P	HOURS/WEEEEK	CREDIT	PE	FINAL	TOTAL
3	0	0	3	3	50	50	100

COURSE OBJECTIVES: Students will be able to understand about

1.	To present the principles associated with basics of production management and to apply these principles in the day-to-day life.
2.	To understand the break-even point for manufacturing a product, criteria for replacement or retention of products.
3.	The course aims at material requirements, resource planning and inventory management.
4.	Know about maintenance methods and other concepts such JIT and lean manufacturing
5.	To understand the philosophy of using techniques of work measurement and method study to improve the existing manufacturing method.

COURSE OUTCOMES: Students will be able to understand about

CO1	Able to solve various basic problems in the field of engineering and management
CO2	Able to Perform brake even analysis under different conditions, to perform replacement or retention using different methods and estimate the cost of products/equipment.
CO3	Understand the factors influencing decisions related to inventory, purchase, plant location, layout and Material Handling Systems
CO4	Apply the concept of JIT, Lean manufacturing & MRP.
CO5	Apply the concept of work study and ergonomics to increase the productivity of industry.

COURSE CONTENT DETAILS:

MODULE	TOPICS/SUBTOPICS
1	Production Management and Forecasting 1.1: Production and Production Management, Production System 1.2 Objectives of Production Management, Scope of Production Management 1.3 Types of Production system: Make to Stock System, Make to Order, Job type, Batch Type and Mass production System 1.4 Definition, objectives and activities of Industrial Engineering 1.5 Functions and techniques of Industrial Engineer Course Outcome: CO1 Teaching Hours: 8 hrs
2	Facility Layout and Engineering Economy 2.1 Process Chart: Operation Process Chart, Flow Process Chart, Two Handed Process Chart, Multiple Activity Chart 2.2 Plant Layout: Objectives of Plant layout, Plant Layout Problems, Objectives of plant Layout, Advantages of Plant Layout, Types of Plant Layout 2.3 Concept of Replacement and Depreciation 2.4 Brake Even Analysis 2.5 Cost and its elements, Overhead, Fixed and Variable Cost Course Outcome: CO2 Teaching Hours: 8 hrs
3	Material Management and Inventory Control 3.1 Material Management-objectives 3.2 Inventory-concept, types, objective, associated cost 3.3 EOQ, buffer stock, reorder point, fixed reorder quantity system, periodic reorder system, ABC analysis 3.4 Material Requirement Planning Course Outcome: CO3 Teaching Hours: 8 hrs
4	Plant Maintenance, JIT and Forecasting 4.1 Plant Maintenance: -Break down, Scheduled and Preventive maintenance, Steps in preventive 4.2 JIT - Production wastages and its control, Elements of JIT, Implementation of JIT 4.3 Definition of Forecasting, Need for Forecasting 4.4 Classification of Forecasting Method Course Outcome: CO4 Teaching Hours: 8 hrs
5	Work Study 5.1 Introduction, Importance of work study, advantages of work study and procedure 5.2 Method Study-Objectives, Scope and procedure of method study, selection of job for method study 5.3 Principles of motion economy 5.4 Man -machine chart, Therblig 5.5 Work Sampling Course Outcome: CO5 Teaching Hours: 6 hrs

REFERENCE BOOKS:

S. N.	Title	Author, Publisher, Edition And Year Of Publication	Isbn
1.	Industrial Engineering & Management	O. P. Khanna	81-7409-099-1
2.	Industrial Engineering & Production Management	Martand Telsang; S Chand & Company Ltd.First;2005	81-219-1773-5
3.	Elements Of Workshop Technology, Vol. I & II	Hazra S. K. And Chaudhary, Media Promoters & Publishers Pvt.Ltd.	81-85099-14-6

E-REFERENCES:

1. <https://youtu.be/gPaBULgRRuM?si=KQx2k1BJBOJRpjzF>
2. <https://youtu.be/KgQyuCrOKoU?si=iDg0pItHvcFoql36>
3. https://youtu.be/YXP_jNhtDI?si=BdSek6RaGcJIBasd

Mapping of Course Outcomes onto Program Outcomes

	PO1	PO2	P3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	2	2	1	2	3	3	2	2	3
CO2	3	2	2	1	2	2	3	2	2	3
CO3	3	3	2	2	2	2	3	2	2	3
CO4	1	3	2	1	2	2	3	2	2	3
CO5	2	2	2	1	2	1	2	3	2	3

UNIVERSITY POLYTECHNIC
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SYLLABUS (CBCS)-2023
COURSE: OPERATION RESEARCH

PROGRAMME: DIPLOMA							
COURSE CODE: DPE 653			Course Title: Operational Research				
COMPULSARY / OPTIONAL: OPTIONAL							
Teaching Scheme and Credits					EXAMINATION SCHEME		
L	T	P	HOURS/WEEEEK	CREDIT	PE	FINAL	TOTAL
3	0	0	3	0	50	50	100

COURSE OBJECTIVES: Students will be able to understand about

1.	Define and formulate linear programming problems and appreciate their limitations.
2.	Solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained and translate solutions into directives for action.
3.	Conduct and interpret post-optimal and sensitivity analysis and explain the primal- dual relationship.
4.	Develop mathematical skills to analyze and solve integer programming and network models arising from a wide range of applications.
5.	To know about decision theory and game theory techniques

COURSE OUTCOMES: After the completion of this course, students will be able to

CO1	Identify and develop operational research models from the verbal description of the real system.
CO2	Understand the mathematical tools that are needed to solve optimization problems.
CO3	Develop a report that describes the model and the solving technique, analyses the results and propose recommendations in language understandable in Management Engineering.
CO4	Multi-criteria decision techniques, Decision making under uncertainty and risk, Game theory, and Dynamic programming.
CO5	Use mathematical software to solve the proposed simulation models.

COURSE CONTENT DETAILS:

MODULE	TOPICS/SUBTOPICS
1	Introduction and Allocation: - 1.1 Development of OR – Definitions-Operation Research models–scope and applications. 1.2 Introduction, Requirement of LPP, Basic Assumptions, Formulation of LPP, General Statement of LPP, 1.3 Solution techniques of LPP: Graphical Methods, 1.4 Simplex method, procedure to obtain optimal solution by simplex method, Use of slack / surplus / artificial variables, 1.5 alternative optimal solution minimization and Maximization problem BIG M and TWO-PHASE methods, degeneracy. Duality in LPP, Dual problem and its construction, interpretation and properties, Dual simplex algorithm. Course Outcome: CO1 Teaching Hours: 10 hrs
2	Transportation & Assignment problems: 2.1 Mathematical statement of T.P. Methods to obtaining the initial basic feasible solution. 2.2 Transportation problem -North west corner method -Least cost method - Vogel's approximation method -Modi method, 2.3 Unbalance and degeneracy in transportation model 2.4 Assignment Problem– Formulation – Optimal solution 2.5 Hungarian method Course Outcome: CO2 Teaching Hours: 8 hrs
3	SCHEDULING AND NETWORK ANALYSIS 3.1 Problem of sequencing. Shop sequencing, 3.2 Processing 'n' jobs through two machines and three machines 3.3 Processing two jobs through 'm' machines. 3.4 PERT and CPM, Total slack, free slack, 3.5 Probability of achieving completion date -Cost analysis. Course Outcome: CO3 Teaching Hours: 6 hrs
4	Queuing Theory 4.1 Basis of Queuing theory, 4.2 Input process, queue discipline, service mechanism, inter arrival times, service time, 4.3 Kendall's notation queuing models, M/M/1 and with finite queue model with poisson arrival with exponential service, 4.4 multi-channel queuing model. The [M/M/1: (/SIRO)] model III [M/M/1: (N/FIFO)] 4.5 Model IV (Birth death process M/M/C Queuing systems with M/M/C: (/ FIFO) M/M/C (N/FIFO) M/M/C (C/FIFO) Queues in series. Course Outcome: CO4 Teaching Hours: 8 hrs
5	Game Theory 5.1 Introduction, 5.2 Characteristics of Game Theory 5.3 Two Person, zero sum games, Pure strategy. 5.4 Dominance theory, Mixed strategies (2x2, M x2), 5.5 Algebraic and graphical methods. Course Outcome: CO5 Teaching Hours: 8 hrs

REFERENCE BOOKS:

S. N.	Title	Author, Publisher, Edition and Year of publication	ISBN
1.	Operations Research	Prem Kumar Gupta & D S Hira, S Chand,2023	81-219-0218-9
2.	Operations Research, Theory and Applications	4 th Ed. Macmillan India, 2009.	9789350593363, 9789350593363
3.	Operations Research Introduction to Management Science	Swarup Kanti, Gupta PK (Dr), Mohan Man, Sultan Chand & Sons,20 th ,2022	93-5161-183-7
4.	Operations Research – An Introduction –	Fifth edition by Hamdy A Taha- Prentice Hall of India,6 th	0132729156, 9780132729154

E-REFERENCES:

1. Website:<http://nptel.iitm.ac.in/video.php?subjectId=112106134>
2. <https://nptel.ac.in/courses/112103019/>
3. <https://www.tandfonline.com/>
4. Web links and Video Lectures (e-Resources): E-book
URL:<https://www.pdfdrive.com/non-conventional-energy-sources-e10086374.html>

TEACHING METHODOLOGY

Course Delivery methods	TEACHING METHODOLOGY	
CD1	Lecture by use of boards/LCD projectors	√
CD2	Tutorials/Assignments	√
CD3	Seminars	√
CD4	Industrial/guest lectures	
CD5	Self- learning such as use of NPTEL materials and internet	√

Mapping of Course Outcomes onto Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
C01	2	2	2	1	2	1	3
C02	2	2	2	1	2	2	2
C03	2	2	2	1	2	1	2
C04	2	2	2	1	2	1	2
C05	2	3	2	2	2	2	3

UNIVERSITY POLYTECHNIC
B.I.T., MESRA – 835215 (RANCHI)
SYLLABUS (CBCS)-2023

COURSE: MOTOR VEHICLE TECHNOLOGY

PROGRAMME: DIPLOMA							
COURSE CODE: DOE 612				Course Title: Motor Vehicle Technology			
COMPULSARY / OPTIONAL: OPTIONAL							
Teaching Scheme and Credits					EXAMINATION SCHEME		
L	T	P	HOUR/WEEK	CREDIT	PE	FINAL	TOTAL
3	0	0	3	3	50	50	100

COURSE OBJECTIVE: This course envisions imparting the students to

1	To understand the transmission and Drive systems.
2	Various working principles and Mechanism of the Automobile components systems
3	Introduction & study of front axle assemblies and Electronic controlled systems.
4	Familiarisation of Manual and Automatic control and Driving systems.
5	Knowledge Automobile Electrical Components, charging system and possible defects and remedies.

COURSE OUTCOME: After the completion of this course, students will be able to

CO1	Students will be able to understand the transmission and gain knowledge in Drive systems.
CO2	Grab knowledge on various working principles and Mechanism of the Automobile components systems.
CO3	Students will be introduced to front axle assemblies and Electronic controlled systems & will briefly study the above.
CO4	Students will be given knowledge on Manual and Automatic control and Driving systems with all precautions.
CO5	Brief idea on Automobile Electrical Components, charging system and possible defects and remedies.

COURSE CONTENT DETAILS:

Module	Topic/ Subtopic
1	Clutch: 1.1 Principle, torque transmission, 1.2 types of clutches, lining, friction and bonding material, 1.3 single plate clutch, multiple spring single plate clutch, 1.4 driven plate, multiple plate clutch, 1.5 automatic clutch action, fluid flywheel. CO 1 Teaching hr.: 8hr
2	Gear Box, Propeller and Differential Shaft: 2.1 Function, working of selective gear box - sliding mesh type, constant mesh type, synchronous type, 2.2 torque converter and overdrive, propeller shaft and rear axle, 2.3 universal joint, differential, automatic transmissions. 2.4 Function of propeller shaft, 2.5 Types of propeller joints: - Universal, Hooks, Balls & Trunnion Joints. 2.6 Necessity & function of final drive CO2 Teaching hr.: 8hr
3	Transmission System: 3.1 Requirements, live axle transmission, 3.2 rear engine with live axle, dead axle and axle less transmission, 3.3 four-wheel drive and all-wheel drive transmission, drive line operation. 3.4 Principle & necessity of suspension systems, 3.5 Types of springs (leaf, Coil, Torsion Bar), Front suspension, Stabilizer bar, Rear Suspension, 3.6 Air Suspension, Shock Absorber, Automatic Lever Control, 3.7 Introduction of electronic controlled suspension systems CO3 Teaching hr.: 8hr
4	Front Axle & Steering: 4.1 Introduction & study of front axle assemblies. 4.2 Types of front Axle:- Dead, Live, Elliot & Lamoine front wheel assembly, 4.3 Correct steering angle, Steering gearbox, Worm, Wheel Worm & Roller, Rack & Pinion type, 4.4 Ackerman linkage, Power Steering, and Electronic controlled Power Steering System. CO4 Teaching hr.: 8hr

5	Miscellaneous Automobile System: 5.1 Automobile Electrical Components, charging system, starting system, lighting system. 5.2 Speedometer, fuel gauge, Temperature gauge, RPM meter, Horn circuits, power door and windows, 5.3 Introduction, Chassis lubrication, Types of body, constructional details, types of frames & frameless, 5.4 materials of frames, load consideration, possible defects and remedies, 5.5 Types of lubricants, their uses, properties different lubricants used in various automobile components. CO5
	Teaching: 8hr

Text Book:

1. Automobile Engineering Vol.-I & II
2. Automobile Engineering
3. Automotive Mechanics

By Kirpal Singh.
By G.B.S. Narang.
By W.H. Crouse.

REFERENCE BOOKS:

S. N.	Title	Author, Publisher, Edition and Year of publication	ISBN
1.	Automobile Engineering Vol.-I & II	Kirpal Singh.	81-86308-01-6
2.	Automobile Engineering	G.B.S. Narang.	
3.	Automobile Engineering	K K Jain, K B Asthana (Tata Magraw Hill)	0-07-044529-X
4.	Automobile Engineering	K K Ramalingam	81 8842 9481 1
5	Automobile Engineering Vol. I & II	K M gupta	81-88114-220-0

E REFERENCE:

1. <https://nptel.ac.in/courses/112103019/>
2. <https://www.tandfonline.com/>
3. Web links and Video Lectures (e-Resources): E-book URL: <https://www.pdfdrive.com/non-conventional-energy-sources-e10086374.html>

TEACHING METHODOLOGY:

Course Delivery Methods	TEACHING METHODOLOGY	
CD1	Lecture by use of boards/LCD projectors	√
CD2	Tutorials/Assignments	√
CD3	Seminars	√
CD4	Industrial/guest lectures	
CD5	Self- learning such as use of NPTEL materials and internet	√

Mapping of Course Outcomes onto Program Outcomes

	PO1	PO2	P3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	2	2	2	1	3
CO2	2	2	2	2	2	2	2	1	3	3
CO3	2	3	3	2	2	2	1	0	2	3
CO4	3	1	1	2	2	2	2	2	3	3
CO5	3	3	2	2	2	2	2	3	3	3

UNIVERSITY POLYTECHNIC
B.I.T., MESRA – 835215 (RANCHI)
SYLLABUS (CBCS)-2023
COURSE: DOE 601 ELECTRIC VEHICLE

PROGRAMME: DIPLOMA							
COURSE CODE: DOE 613				Course Title: Electric Vehicle			
COMPULSARY / OPTIONAL: OPTIONAL							
Teaching Scheme and Credits					EXAMINATION SCHEME		
L	T	P	HOUR/WEEK	CREDIT	PE	FINAL	TOTAL
3	0	0	3	3	50	50	100

COURSE OBJECTIVE: This course envisions imparting the students to

1	Learn the environmental impact and history of Electric Vehicles and types of Electric vehicles.
2	Understand and test the concept of EV drive Trains.
3	Describe the configurations of storage system.
4	Familiarisation of Manual and Automatic converter systems.
5	Summarize the E-Mobility and Indian EV Policy.

COURSE OUTCOME: After the completion of this course, students will be able to

CO1	Understand history & importance of Electrical Vehicles.
CO2	Understand working of various Electric Drive Trains.
CO3	Enlist and understand various storage requirements for electric vehicles.
CO4	Understand operation of various types of converters.
CO5	Check ongoing scenario at world and national level in Electric vehicle market.

COURSE CONTENT DETAILS:

Module	Topic/ Subtopic
1	History & Importance of Electrical Vehicles: 1.1 History of Electric Vehicles, Development towards the 21st Century, 1.2 Types of Electric Vehicles in use today, Battery Electric Vehicle, 1.3 Hybrid (ICE & others), Fuel Cell EV, Solar Powered Vehicles. 1.4 Social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Course Outcome: CO1 Teaching Hours: 8 hrs
2	Electric Drive Trains 2.1 Basic concept of electric traction, introduction to various electric drive, train topologies, power flow control in electric drive-train topologies, 2.2 fuel efficiency analysis. Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, 2.3 Configuration and control of DC Motor drives, Configuration and control of 2.4 Induction Motor drives, configuration and control of Permanent Magnet Motor drives, 2.5 Configuration and control of Switched Reluctance Motor drives, drive system efficiency. Course Outcome: CO2 Teaching Hours: 8 hrs
3	Storage Systems 3.1 Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, 3.2 Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, 3.3 Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, 3.4 Hybridization of different energy storage devices. Course Outcome: CO3 Teaching Hours: 8 hrs
4	Converters 4.1 Introduction to AC/DC, DC/AC, AC/AC, DC/DC converters, 4.2 four quadrant operation of converters Course Outcome: CO4 Teaching Hours: 8 hrs
5	Indian & Global Scenarios in Electric Vehicles 5.1 Technology Scenario, Market Scenario, 5.2 Policies & Regulations, 5.3 Payback & Commercial Model, Policies in India Course Outcome: CO5 Teaching Hours: 8 hrs

Text Book:

1. A.K Babu, Electric & Hybrid Vehicle, Second edition, Khanna Publication, 2022.
2. James D. Halderman, Electric and Hybrid Electric Vehicles, First edition Pearson, 2023.

REFERENCE BOOKS:

S.No	Title	Author, Publisher, Edition and Year of publication	ISBN
1	Electrical Vehicle Technology	<u>Prof. Sunil R. Pawar</u>	1685545610
2	Fundamentals of Hybrid and Electric Vehicles	<u>Prof. K.C.Jain</u>	9392549768

E-REFERENCES:

1. <https://www.youtube.com/watch?v=h5ysddrIXLw>
2. <https://www.youtube.com/watch?v=Aa647ghOjGw>
3. <https://www.youtube.com/watch?v=HfN5dEeUyuE>

TEACHING METHODOLOGY:

Course Delivery Methods	TEACHING METHODOLOGY	
CD1	Lecture by use of boards/LCD projectors	√
CD2	Tutorials/Assignments	√
CD3	Seminars	√
CD4	Industrial/guest lectures	
CD5	Self- learning such as use of NPTEL materials and internet	√

Mapping of Course Outcomes onto Program Outcomes

	PO1	PO2	P3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	2	2	2	2	3
CO2	2	2	2	2	2	2	2	2	2	3
CO3	2	3	3	2	2	2	1	2	2	3
CO4	3	1	1	2	2	2	2	2	2	3
CO5	3	3	2	2	2	2	2	3	2	3