Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	ME401	**Title of the Course**	Industrial Engineering	**L**	**T**	**P**	**C**
Year	**IV**	**Semester**	VII	**3**	**1**	**0**	**4**
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	Contribute to the success of companies through effective problem solving. Design, develop, implement, and improve integrated systems that include people, materials, information, equipment, and environments · Effectively manage business operations and project management teams. · Continue to develop holistically, including the personal and professional skills necessary to adapt to our changing societal, technological, and global environments · To be able to adapt and solve the increasingly complex problems faced by industry; embrace innovation through intellectual diversity and creative problem solving; and continue to develop holistically as a learner to become leaders of tomorrow.						

Course Outcomes	
CO1	Apply knowledge and understanding of productivity models in various industries. Design and develop the products and processes. Apply basic knowledge of product development and industrial process design.
CO2	Analyze the facility location and network models. Understanding of supply chain system.
CO3	Interpretation and analysis of data from aggregate output planning models. Knowledge and understanding of Human Factors Engineering and various job design techniques.
CO4	Select and analyze an inventory control model. Understanding of manufacturing resources and queuing systems.
CO5	Analyze and control the quality of an end product. Analysis of industrial systems using linear and non-linear programming approaches.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Introduction	Introduction : Concept of Industrial Engineering, Functions of Industrial Engineering, Industrial Engineering techniques, Role of an Industrial Engineer. Applications of Industrial Engineering. 4 Production and Productivity : Concept of production, production function, production system, Definition of productivity, Difference between productivity and production, Productivity, efficiency and effectiveness. Measurement of productivity, Types of productivity, productivity index, ways to improve productivity.	8	CO1
2	Job Evaluation and Merit Rating	Job Evaluation and Merit Rating : Concept of job evaluation, job analysis, job description, job simplification, job evaluation methods, Definition and methods of merit rating, wage-incentive payment plans. 4 Plant Layout and Materials Handling: Considerations in plant location, Definition of plant layout, types of layout, Principle of plant layout, Material, handling, Material handling equipments. 2 Production Planning and Control (PPC) Objectives of PPC, Functions of PPC, production planning, steps in PPC, effectiveness of PPC system.	8	CO2
3	Depreciation and Replacement	Depreciation and Replacement : Concept of depreciation and obsolescence, Classifications of depreciation, Methods of charging depreciation, Service life of an asset, Replacement of items which deteriorate with time. 2 Inventory Control : Inventory, function of inventory, inventory costs, Deterministic inventory models. 3 Statistical Quality Control: Introduction, Process control, Control charts, acceptance plan, acceptance sampling, single, Double and sequential Sampling plans, concept of average outgoing quality.	6	CO3
4	Industrial Ownership	Industrial Ownership: Introduction, Sole proprietor enterprise, partnership firm, joint stock company, Classification of company, Comparison of Public, Private and Joint sector, Cooperative organization. 4 Factory Legislation in India : Importance and principles of Labour legislation, Factory Act, Payment of wages Act, Minimum wages Act, Workmen's compensation Act, Employee's State Insurance Act.	8	CO4
5	Break-Even-Analysis	Break-Even-Analysis : Introduction and purpose of BEA, Assumptions, Steps in BEA, Fixed Cost, Variable cost, Margin of safety, Angle of incidence, Profit volume graph. 4 Brief Introduction of the Following Terms: Concept of optimization, Concept of value engineering Total quality management, Management of Projects, Management information systems, Professional and business Ethics, Environmental pollution.	8	CO5

Reference Books:

1. Industrial Engineering: M.I. Khan, New-Age Int.
2. Industrial Engineering and Management: O.P. Khanna, Dhanpat Rai
3. Principles of Management, An Analysis of Management Fuction: H.Kontz and C.D. Donnel
4. Manufacturing Management: J.Moore, Prentice Hall.

e-Learning Source:

https://www.youtube.com/watch?v=yhywrCChJBQ&list=PLLy_2iUCG87D5n9zraFS2QYajk0OAOlVK

https://www.youtube.com/watch?v=yYIVumq6sVM&list=PL299B5CC87110A6E7

https://www.youtube.com/watch?v=r-o86V4zcMM&list=PLbjTnj-t5Gkl0z3OHOGK5RB9mvNYvnImW

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	2	1					3	3	2	3
CO2	3	3	3	2	2	3	1					2	3	3	2
CO3	3	3	2	2	2	3						2	3	2	3
CO4	3	2	2	2	3	3	1					2	3	3	2
CO5	3	1	1	1	1	3						2	3	2	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2018-2019							
Course Code	ME402	**Title of the Course**	CAD & CAM	**L**	**T**	**P**	**C**
Year	**IV**	**Semester**	VII	**3**	**1**	**0**	**4**
Pre-Requisite	**NONE**	**Co-requisite**	**NONE**				
Course Objectives	1. Provide basic foundation in computer aided design / manufacturing 2. Understand the fundamentals used to create and manipulate geometric models 3. Get acquainted with the basic CAD software designed for geometric modeling 4. Learn working principles of NC machines CNC control and part programming 5. Understand concept of Group Technology, FMS and CIM						

Course Outcomes	
CO1	Describe basic structure of CAD workstation, Memory types, input/output devices and display devices and computer graphics
CO2	Acquire the knowledge of geometric modeling and Execute the steps required in CAD software for developing 2D and 3D models and perform transformations
CO3	Explain fundamental and advanced features of CNC machines
CO4	Illustrate Group Technology, CAQC and CIM concepts
CO5	Know about the Concept of Mechatronics and Robotics

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction and Review of Computer Programming	Introduction and Review of Computer Programming : Introduction to CAD/CAE, Elements of CAD, Concepts of integrated CAD/CAM, CAD Engineering applications, its importance and necessity. Review of C, C++. Introduction to MATLAB; Multiplication, addition, subtraction and division. Utility and application. Functions and 2D plots. Computer Graphics-I Computer systems, Graphics input devices-cursor control devices, Digitizers, Scanners, speech oriented devices and touch panels, Graphics display devices CRT, colored CRT monitors, Color models, DVST, Flat-panel display, Graphics output Devices	8	CO1
2	Computer Graphics	Computer Graphics -II Graphics software, Graphics functions, output primitives-Bresenham's line drawing and Mid-point circle algorithms. Geometric Transformations: Word/device co-ordinate representations, 2D and 3D geometric transformations, Matrix representations-translation, scaling, shearing, rotation and reflection, composite transformations, concatenation about arbitrary axis. Exercise and programs	8	CO2
3	Introduction to NC Machines	Introduction to NC Machines: Introduction to Automation, Need and future of NC systems and CAM; Advantages and disadvantages; Classification; Open and closed loop systems; Historical development and future trends. NC Part programming: (a) Manual (word address format) programming; Examples Drilling and Milling. (b) APT programming. Geometry, Motion and Additional statements, Macro-statement	8	CO3
4	Computer Integrated Manufacturing System	Computer Integrated Manufacturing System: Group Technology, Manufacturing cell, Transfer lines, FMS, CIM, CAD/CAM, CAPP, Concept of Mechatronics Interpolators: Principle, Digital Differential Analyzers; Linear interpolator, Circular Interpolator and its software. Control of NC Systems: Open and closed loops. Automatic control of closed loops with encoder and tachometers; Speed variation of DC motor; Adaptive control.	8	CO4
5	Numerical Methods	Numerical Methods : Introduction to curve fitting methods. Root-finding and Optimization techniques. Bisection method, Regula-Falsi Method, Newton Raphson method, Interpolation Lagrange and Newton's interpolation, Curve fitting-Least Square method Numerical integration-Trapezoidal and Simpson Method. Finite Element Methods: Introduction and Application of FEM, Stiffness Matrix/Displacement Matrix, One/Two Dimensional bar and beam element (as spring system) analysis.	8	CO5

Reference Books:

Computer Graphics: Hearn and Baker (Pearson/Prentice hall)

Computer Aided Design : R.K. Srivastava

Computer Graphics, Theory and Practice: Foley, Van Dam, Feiner, (Pearson Education)

CAD/CAM, Theory and practice: Ibrahim Zeid (McGraw Hill International)
Computer Aided Analysis and Design of Machine Elements: (Rao and Dukkipati)
Mathematical Elements for Computer Graphics: Rogers and Adams (McGraw Hill)
CAD/CAM : Groover and Zimmers (Prentice Hall of India Pvt. Ltd.)
Computer Oriented Numerical Methods: Rajaraman (Prentice Hall)
e-Learning Source:
https://www.youtube.com/watch?v=EgKc9L7cbKc&list=PLC3EE33F27CF14A06
https://www.youtube.com/watch?v=1gDmNDJ9SHc&list=PL1F857AA89C464B15
https://www.youtube.com/watch?v=sp7JwktN9fo

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1	2	2	1	3	1	1	2	3	3	2	2
CO2	3	3	3	1	2	3	1	1	2	1	2	3	3	2	3
CO3	3	3	3	2	2	3	1	2	2	1	2	3	3	3	2
CO4	2	3	3	2	2	3	3	1	1	2	3	1	3	3	3
CO5	3	3	2	2	3	3	2	1	1	1	3	2	2	3	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	ME403	**Title of the Course**	DRILLING TECHNOLOGY FOR WATER, OILS AND MINERAL EXPLORATION	**L**	**T**	**P**	**C**
Year	**IV**	**Semester**	VII	**3**	**1**	**0**	**4**
Pre-Requisite	**NONE**	**Co-requisite**	**NONE**				
Course Objectives	1. To Understand History of Drilling, Geology 2. Study of Classification of rocks 3. To know about application of Geo-physics 4. Geo-chemical prospecting and remote sensing for water 5. Soil testing location of site**.**						

Course Outcomes	
CO1	Isolate the key features of a drilling technology for oil, water, and minerals.
CO2	Indicate how the properties of drilling fluid affect drilling methods, Develop soil testing method and finding its site
CO3	Describe the role of drilling fluid in improving the material removal rate, Develop fundamental Knowledge of the drilling fluid & its chemical composition.
CO4	Identify the method of Geo-chemical prospecting and remote sensing for water.
CO5	Estimate the different fluid property and develop the understanding of geo-physics

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	History of Drilling	History of Drilling, Geology & classification of rocks, Application of Geo-physics, Hydrology, Geochemical prospecting and remote sensing for water, oil & mineral exploration, soil testing location of site.	8	CO1
2	Drilling Logging and Testing	Drilling Logging and Testing Reverse and direct rotary, Percussion, DTH, Odex Drilling, Conventional, Wire Line, Auger Drilling and Drilling for Standard Penetration Test (SPT). Borehole Logging ,Drill stem test,	8	CO2
3	Drilling Fluids	Drilling Fluids Type of Drilling Fluid, Bentonite –constituents, Maintenance of parameters, Viscosity, Sp. Gravity, Filtration loss, Additives to maintain parameters, use of polymers as fluids.	8	CO3
4	Water Well Drilling Origin	Water Well Drilling Origin, occurrence and movement of ground water, Genetic classification of water, Aquifer, Transmissibilty, Darcy's law, Coefficient of Permeability, Construction of tube well, well development, drilling method, placement Gravel pack,	8	CO4
5	Drilling for Oil and Minerals Exploration Diamond Drilling	Drilling for Oil and Minerals Exploration Diamond Drilling, Horizontal, vertical and directional Drilling, Core samples, Geotechnical order (GTO), Deviation in borehole and wedge design, , Geothermal Drilling, Oil Drilling Exploration.	8	CO5

Reference Books:

1. Diamond Drilling Technology by C.P Chug, Oxford publication
2. A Handbook of Drilling Technology by C.P Chug, Oxford publication

e-Learning Source:

https://www.youtube.com/watch?v=VE_xMqM-p0k&list=PLSsfsY90RszGPQ1lCN4qpV5HvcYvgOqFs

https://www.youtube.com/watch?v=6E7WEu62DTY

https://www.youtube.com/watch?v=lhx1nvZFPS4&list=PLrb2lGnLJld_E7C0wVAqU4JGabm2IiT38

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	1	2	3	2					1	1	-	-
CO2	1	2	-	-	1	2	2					2	2	1	1
CO3	1	1	1	3	-	2	1					2	-	1	2
CO4	2	-	3	-	1	1	-					3	1	-	1
CO5	1	2	-	2	1	-	3					1	-	3	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	ME404	**Title of the Course**	Total Quality Management	**L**	**T**	**P**	**C**
Year	IV	**Semester**	VII	3	1	0	4
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	1. The overarching learning objective of this course is to develop a comprehensive set of skills that will allow the student to function effectively as Total Quality Managers and introducer of quality concepts. 2. The organizational structure body of knowledge includes techniques for both quantitative and non-quantitative analysis, as well as the team leadership skills necessary to get projects across the goal line. 3. Understanding required defining the metrics behind the operation in an industry to attain the highest level of improvement possible. 4. Identify ethical and unethical behavior in Quality Management and apply various quality improvement techniques.						

Course Outcomes	
CO1	Evaluate the principles of quality management and to explain how these principles can be applied within quality management systems.
CO2	Identify the key aspects of the quality improvement cycle and to select and use appropriate tools and techniques for controlling, improving and measuring quality like 5S or Kaizen
CO3	Critically appraise the organizational, communication and teamwork requirements for effective quality management
CO4	Critically analyze the strategic issues in quality management, including current issues and developments, and to devise and evaluate quality implementation plans
CO5	Develop research skills that will allow them to understand requirements of ISO 9000-2000, Taguchi method, JIT

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Quality Concepts	**Quality Concepts**: Introduction, Need for Quality, Evolution of quality, Definition of quality, Dimensions of manufacturing and service quality, Basic concepts of TQM, Definition of TQM, Contribution of Deming, Juran and Crosby, Barriers to TQM	8	CO1
2	Quality Management:	**Quality Management**: Leadership – Strategic quality planning, Customer satisfaction, Customer complaints, Customer retention, Team and Team work, Continuous process improvement – PDSA cycle, 5S, Kaizen – Supplier partnership – Partnering supplier selection – Supplier rating	8	CO2
3	Control Charts:	**Control Charts**: Theory of quality control charts, measurement range, use of control charts. Construction and analysis of OC curve. **Attributes of Control Charts**: Defects, construction and analysis of control charts, improvement of quality by control chart, variable sample size	8	CO3
4	Defects Diagnosis and Prevention:	**Defects Diagnosis and Prevention**: Defect study, identification and analysis of defects, corrective measure, factors affecting reliability, MTTF, calculation of reliability, Building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle.	8	CO4
5	IS0-9000 and its concept of Quality Management:	**IS0-9000 and its concept of Quality Management**: ISO 9000 series, Taguchi method, JIT in some details	8	CO5

Reference Books:

Lt. Gen. H.LaI, "Total Quality management", Wiley Eastern Limited, 1990

P.N.Mukherjee, “Total Quality Management”, PHI

Greg Bounds. “Beyond Total Quality Management”. McGraw Hill, 1994

Menon, H.G, "TQM in New Product manufacturing", McGraw Hill 1992

e-Learning Source:

https://www.youtube.com/watch?v=5pMWmU_8lfI&list=PLPjSqITyvDeUUUwunyiwq41yJZofQEzMI

https://www.youtube.com/watch?v=VxNIYCMr1Nc&list=PLueDbnzoKDZ-ZIJigjav-j8ZWz5CEoz-0

https://www.youtube.com/watch?v=ksR4Xy6tFcM

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1		2						3	2	3	2
CO2	3	3	3	2		3						3	1	2	2
CO3	3	3	3	2		3						3	3	3	2
CO4	3	2	2	2		3						3	2	2	3
CO5	3	3	2	1		3						3	1	2	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	ME405	**Title of the Course**	Unconventional Manufacturing Processes	**L**	**T**	**P**	**C**
Year	**IV**	**Semester**	VII	3	1	0	4
Pre-Requisite	Manufacturing Science-I, Manufacturing Science-II	**Co-requisite**	NONE				
Course Objectives	1. To impart understanding of different types of modern Machines. 2. To classify and analyze various non-conventional machines and their applications. 3. To analyze material removal mechanism in different unconventional machining processes. 4. To study the parameters involved in efficient working of the unconventional machining processes.						

Course Outcomes	
CO1	The students will understand the principle, working and applications of unconventional machining process, need of unconventional manufacturing processes & its classification and its future possibilities.
CO2	The students will know the principle and working and application of unconventional machining processes like Electro-Discharge machining, Electrochemical machining
CO3	The students will learn the principle and working and application of unconventional machining processes like Laser beam machining, Electron beam machining
CO4	Know the principle and working and application of Unconventional welding processes, Under water welding, Cladding.
CO5	Know the principles, working and applications of High energy forming processes such as Explosive Forming, Electromagnetic forming, Electro-Discharge forming, water hammer forming, explosive compaction

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Introduction	**Introduction:** Limitations of conventional manufacturing processes need of unconventional manufacturing processes & its classification and its future possibilities.	5	CO1
2	Unconventional Machining Process	**Unconventional Machining Process:** Principle and working and applications of unconventional machining process Electro-Discharge machining, Electrochemical machining, Abrasive jet machining etc	8	CO2
3	Unconventional Machining Process (continued	**Unconventional Machining Process (continued):** Principle and working and application of unconventional machining processes, Laser beam machining, Electron beam machining, welding Ultrasonic machining etc.	8	CO3
4	Unconventional welding processes	**Unconventional welding processes:** Explosive welding, Cladding etc.. Under water welding, Metalizing, Plasma arc welding/cutting etc	8	CO4
5	Unconventional Forming processes	**Unconventional Forming processes:** Principle, working and applications of High energy forming processes such as Explosive Forming, Electromagnetic forming, Electro-Discharge forming, water hammer forming, explosive compaction etc. **Electronic-device Manufacturing:** Brief description of Diffusion and Photo- Lithography process for electronic-device manufacturing.	11	CO5

Reference Books:

Modern Machining Processes – P.C. Pandey

Unconventional Machining – V.K. Jain

e-Learning Source:

https://www.youtube.com/watch?v=cxU1zUOpGLk&list=PLtpJfjyaifnmCI-JcNxs6uQgv3b2WYKzS

https://www.youtube.com/watch?v=06QxjEAMrKc&list=PLwFw6Nkm8oWqFJUxiUuu5c0uHK076lz2K

https://www.youtube.com/watch?v=oI3RIAvyVxc&list=PLbMVogVj5nJSzoQXmu7dsj9ZKJyZ1P4O8

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2						1	3	3	1	3
CO2	3	3	3	3	2						1	3	3	1	3
CO3	3	3	3	3	2						1	3	3	1	3
CO4	3	3	3	3	2						1	3	3	1	3

CO5	3	3	3	3	2						1	3	3	1	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	ME406	**Title of the Course**	Energy Conservation and Waste Heat Recovery	**L**	**T**	**P**	**C**
Year	IV	**Semester**	VII	3	1	0	4
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	1. Able to have the basic concepts of thermodynamics and waste heat recovery systems. 2. To understand and analyze the different gas power cycles. 3. Be able to perform the analysis of heat exchangers of different types by LMTD and NTU methods. 4. Understand the various types of direct conversion technologies. 5. Understand the various types of energy storage techniques						

Course Outcomes	
CO1	Explain basic concepts of thermodynamics and importance of waste heat recovery.
CO2	Understanding of thermodynamic cycles and heat exchangers.
CO3	Analysis of heat exchanger
CO4	Concept of direct energy conversion technologies
CO5	Explain the concept of energy storage techniques.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Introduction to Waste Heat	Introduction to Waste Heat, Importance of Waste Heat Recovery, Review of Thermodynamics – Introduction to First and Second Laws, Entropy, Entropy Generation, First and Second Law efficiency	8	CO1
2	Gas Turbine Cycle	Gas Turbine Cycle, Combined Cycle, Combined Gas Turbine-Steam Turbine Power Plant, Heat Recovery Steam Generators Thermodynamic cycles for low temperature application, Cogenerations, Introduction to Heat Exchangers, Analysis – LMTD and ε-NTU method	8	CO2
3	Analysis of Heat Exchanger	Analysis of Heat Exchanger – continued, Problem solving, Special Heat Exchangers for Waste Heat Recovery, Synthesis of Heat Exchanger Network Heat pipes &Vapor Chambers, Direct conversion technologies – Thermoelectric Generators.	8	CO3
4	Direct conversion technologies	Direct conversion technologies – Thermoelectric Generators (contd.), Thermoionic conversion, Thermo-PV,MHD Heat Pump; Heat Recovery from Incinerators, Energy Storage – Introduction	8	CO4
5	Energy Storage Techniques	Energy Storage Techniques – Pumped hydro, Compressed Air, Flywheel, Superconducting Magnetic storage. Energy Storage Techniques – Thermal storage (Sensible & Latent), Battery, Chemical Energy Storage, Fuel cells.	8	CO5

Reference Books:

Cengel& Boles, "Thermodynamics: An Engineering Approach", McGraw Hill.

Ramesh K.Sash and DusanP.Sekulic, “Fundemantals of Heat Exchanger Design” Wiley.com

e-Learning Source:

https://www.youtube.com/watch?v=IM1QLY2NP3I&list=PLSGws_74K019s_QRXAm-icFCKCalbggHO

https://www.youtube.com/watch?v=WTgGO3izbqQ&list=PLlXSx0DYmBXdsrpW2n2pqdenxenqQ3x6v

https://www.youtube.com/watch?v=cc1BZz-_110&list=PLSkUIlSSc32xJgmyqOgpNTH-7kbTxZg9r

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3		2	2					3	3	2	2
CO2	3	3	3	3		3	2					3	3	3	2
CO3	3	3	3	2		3	3					3	3	2	3
CO4	3	3	2	2		3	3					3	3	2	3
CO5	3	3	2	2		3	3					3	3	2	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	ME407	**Title of the Course**	Automobile Engineering	**L**	**T**	**P**	**C**
Year	**IV**	**Semester**	VII	**3**	**1**	**0**	**4**
Pre-Requisite	Machine Design (ME301), Kinematics of Machine (ME 20	**Co-requisite**	NONE				
Course Objectives	The purpose of this course is to impart adequate knowledge in both practically and theoretically, covering the various types of power-driven vehicles and to familiarize the students with the fundamentals of Automotive Engine System, Chassis and suspension system, braking and transmission system, and cooling system. The students are acquainted with the operation, maintenance and repairs of all components of the various transportation vehicles.						

Course Outcomes	
CO1	List different types of Engine and their classifications
CO2	Develop concept and define working of Automobile Engine cooling and lubrication system
CO3	Describe functioning of Transmission train, conventional and non-conventional drives, Clutches, Gear boxes, Synchromesh device, Propeller shaft, Differential axle, braking system and Suspension systems
CO4	Describe functioning of steering system, steering geometry wheel alignment and wheel angles for modern Automobile
CO5	Describe cooling system and Lubrication system

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Power unit and Gear Box	**Power unit and Gear Box:** Principles of Design of main components. Valve mechanism. Power and Torque characteristics. Rolling, air and gradient Resistance. Tractive effort. Gear Box. Gear ratio determination. Design of Gear box.	8	CO1
2	Transmission System	**Transmission System:** Requirements. Clutches. Torque converters. Over Drive and free wheel. Universal Joint. Differential Gear Mechanism of Rear Axle. Automatic transmission. Steering and Front Axle. Castor Angle, Wheel chamber and Toe in Toe out etc. Steering geometry. Ackerman Mechanism. Understeer and Oversteer.	8	CO2
3	Braking System	**Braking System**: General requirements, Road, tyre adhesion. Weight transfer. Braking ratio. Mechanical brakes, Hydraulic brakes. Vaccum and air braks, Thermal aspects **Chasis and Suspension System**: Loads on the frame. Strength and stiffness. Various suspension systems.	6	CO3
4	Electrical System:	**Electrical System:** Types of starting motors, generator and regulators, lighting system. Ignition system, Horn, Battery etc. **4** **Fuel Supply System:** Diesel and Petrol vehicle system such as Fuel Injection Pump, Injector and Fuel Pump, Carburetor etc. MPFI	8	CO4
5	Automobile Air Conditioning	**Automobile Air Conditioning:** Requirements, Cooling and heating systems **Cooling and Lubrication System:** Different type of Cooling and lubrication system. **Maintenance System:** Preventive Maintenance, break down maintenance, and over hauling system.	8	CO5

Reference Books:

1. Automotive Engineering : Hietner
2. Automobile Engineering : Kripal Singh
3. Automobile Engineering : Narang
4. Automotive Mechanics : Crouse
5. Automobile Engineering : Newton and Steeds

e-Learning Source:

https://www.youtube.com/watch?v=hs7bABMtOMI&list=PLyqSpQzTE6M9G2SNxKfsVEjcM9MlJau4F

https://www.youtube.com/watch?v=LZ82iANWBL0&list=PLbMVogVj5nJTW50jj9_gvJmdwFWHaqR5J

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	2	1					3	3	2	3
CO2	3	3	3	2	2	3	1					2	3	3	2
CO3	3	3	2	2	2	3						2	3	2	3
CO4	3	2	2	2	3	3	1					2	3	3	2
CO5	3	1	1	1	1	3						2	3	2	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	ME408	**Title of the Course**	MECHANICAL SYSTEMS DESIGN	**L**	**T**	**P**	**C**
Year	**IV**	**Semester**	VII	**3**	**1**	**0**	**4**
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	1. To impart the knowledge about system concept of engineering, role of engineer, concurrent engineering, Problem formulation. 2. To know about system theories and system modeling. 3. To impart knowledge about linear graph analysis and optimization concepts. 4. To understand system evaluation and calculus methods for optimization. 5. To know about decision analysis and system simulation.						

Course Outcomes	
CO1	Apply system concept of engineering, engineering activity matrix, solve engineering problems and formulate problems.
CO2	Understand black box approach, state theory approach, concepts of linear graph modeling and mathematical modeling.
CO3	Understand black box approach, state theory approach, concepts of linear graph modeling and mathematical modeling.
CO4	Assess feasibility, plan horizon, financial analysis and to understand the concept of model with one and two decision variables.
CO5	Learn the elements of decision problem, utility value and to apply Baye's theorem.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Fundamental Concepts and Definitions	Fundamental Concepts and Definitions: Apply system concept of engineering, engineering activity matrix, solve engineering problems and formulate problems.	8	CO1
2	Understand black box approach	Understand black box approach, state theory approach, concepts of linear graph modeling and mathematical modeling.	8	CO2
3	Analyze path problems	Analyze path problems, network flow problems and to understand the concept and methods of optimization	8	CO3
4	Assess feasibility	Assess feasibility, plan horizon, financial analysis and to understand the concept of model with one and two decision variables	8	CO4
5	Learn the elements of decision problem	Learn the elements of decision problem, utility value and to Apply Baye's theorem.	8	CO5

Reference Books:

Design and Planning of Engineering System: D.D. Meredith, K.V.Wong, R.W. Woodhead, R.R. Worthman, prentice-Hall Inc. Englewood Clifts, New Jersey.

Design Engineering: J.R. Dixon, Tata McGraw Hill.

Optimization Techniques: S.S. Rao.

System Analysis and Project Management : Devid I, Cleland, William R. King, Mc. Graw Hill.

Engineering Design : Robot Matousck, Blackie and son.

e-Learning Source:

https://www.youtube.com/watch?v=-LiNZYpk870&list=PLm_MSClsnwm_fIdzKR-ARchhAG0KL0iYn

https://www.youtube.com/watch?v=mzWMdZZaHwI&list=PL3D4EECEFAA99D9BE

https://www.youtube.com/watch?v=SHbb9dV-we8&list=PLBE92469895618E50

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2		2						3	3	1	1
CO2	2	3	3	2		3						3	2	3	2
CO3	1	3	3	3		3						3	3	2	1
CO4	3	2	3	2		3						3	1	2	1
CO5	2	3	3	3		3						3	3	2	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	ME409	**Title of the Course**	Energy Management	**L**	**T**	**P**	**C**
Year	**IV**	**Semester**	VII	**3**	**1**	**0**	**4**
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	1. Teaching the basic concepts and fundamental aspects of industrial and domestic thermal systems' design. 2. Prepare the students for the positions of energy management in energy intensive industries 3. Ability to identify the energy management skills and strategies in the energy management system. 4. Ability to understand various energy conservation methods useful in a particular industry. 5. Ability to select appropriate energy conservation method for the critical area identified. **6.** Ability to prepare an energy audit report						

Course Outcomes	
CO1	Identify the demand supply gap of energy in Indian scenario Demonstrate basic concepts and importance of non-destructive testing and their application and also the understanding of commonly used NDT methods.
CO2	Carry out energy audit of an industry/Organization.
CO3	Draw the energy flow diagram of an industry and identify the energy wasted or a waste stream
CO4	Select appropriate energy conservation method to reduce the wastage of energy.
CO5	Draw the energy flow diagram of an industry and identify the energy wasted or a waste stream and evaluate the techno economic feasibility of the energy conservation technique adopted

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Introduction to energy	Introduction to energy, Sources of energy, Forms of energy, Energy reserves, renewable energy sources, Unites of energy and the laws of thermodynamics,, Energy consumption and GDP, energy database , Energy demand analysis, Costs of exploration and utilization of depletable resources, energy pricing, National energy plan.	8	CO1
2	Energy audit concepts	Energy audit concepts, Energy audit based on 1st law and 2nd law of thermodynamics, Mass and Energy balances, Availability analysis, Evaluation of energy conserving opportunities, Economic analysis and life cycle costing.	8	CO2
3	Energy conservation areas	Energy conservation areas, Energy transmission and storage, Plant wide energy optimization Models, Data base for energy management, Energy conservation through controls, Computer aided energy management, Program organization and methodology.	8	CO3
4	Electrical energy conservation in building	Electrical energy conservation in building lighting, heating, ventilating and air conditioning, Energy efficient motor, power factor improvement in power systems, Energy audit of Combustion process, Boilers, Turbines, compressors, Pumps, Heat exchangers, Condensers, Use of industrial, wastes.	8	CO4
5	Energy environment interaction	Energy environment interaction, Environmental issues, Global warning, Carbon dioxide emissions, Depletion of ozone layer, Government's regulations, Energy economy interaction.	8	CO5

Reference Books:

1. Energy Management by Clive Beggs, Butterwoth- Heinemann Elsevier Science.
2. Optimising Energy Efficiency in the Industry, By Rajan, Tata Mc Graw Hill Publishers.
3. Guide to energy Management, By C.L Capehart, Fairmont Press.
4. Renewable Energy Sources and their Environment Impact, by Abbasi & Abbasi, Prentice Hall of India
5. Environmental Risks and Hazards by Cutter, Prentice Hall of India.
6. Energy and Power Risk Management: New Developments in Modeling, Pricing and Hedging, buy Alexander Eydeland, John Wiley & Sons
7. Energy Management Handbook by, Wayne C. Turner.
8. Thermodynamics, By Kenneth Wark, Tata Mc Graw Hill Publishers.
9. Exergy Analysis of Thermal, Chemical and Metallurgical Process, By Jan Szargut, David R. Morris, Frank R. Steward, Hemisphere Pub, Springer Verlag Publisher

e-Learning Source:

https://www.youtube.com/watch?v=WwBquDjDGOA&list=PLImNQubhYtnAmyPNwO-nPU-VQIlXH0xqM

https://www.youtube.com/watch?v=8Aqc44PG4Ws

https://www.youtube.com/watch?v=kWcVVbXPTtk&list=PLQmc-I2-FO2GCp2szVRnoIk3e2E5J7oLl

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	2	3				1	3	3	2	3
CO2	3	3	3	2	2	3	2				2	2	3	3	2

CO3	3	3	2	2	2	3	2				2	2	3	3	3
CO4	3	2	2	2	3	3	2				1	2	3	3	2
CO5	3	1	1	1	1	3	3				2	2	3	3	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	ME410	**Title of the Course**	Mechanical Vibrations	**L**	**T**	**P**	**C**
Year	IV	**Semester**	VII	**3**	**1**	**0**	**4**
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	1. Apply theoretical and numerical procedures to predict the dynamic response of discrete or continuous structural systems under the most diverse loading conditions. 2. Understand the main features of the dynamics of nonlinear lumped parameters systems. 3. Develop reduced order models to treat systems with a large number of DOF.beams. 4. Ability to obtain linear mathematical models of real life engineering systems. 5. General notion on frequency and time response of vibratory systems.						

Course Outcomes	
CO1	Apply theoretical and numerical procedures to predict the dynamic response of discrete or continuous structural systems under the most diverse loading conditions.
CO2	Be able to write the differential equation of motion of vibratory systems.
CO3	Be able to make free and forced (harmonic, periodic, non-periodic) vibration analysis of single and multi degree of freedom linear systems.
CO4	Ability to obtain linear mathematical models of real life engineering systems.
CO5	Ability to use Lagrange's equations for linear and nonlinear vibratory systems

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Fundamental Concepts and Definitions	Fundamental Concepts and Definitions: Periodic motion, harmonic motion superposition of simple harmonic motions Fourier analysis, Free vibration, Natural frequency, Equivalent systems, Energy method for determining natural frequency, Torsional vibrations, Damped vibrations, Vibrations of systems with viscous damping, Logarithmic decrement.	8	CO1
2	Forced vibration	Forced vibration, Harmonic excitation with viscous damping steady state vibrations, Forced vibrations with rotating and reciprocating unbalance Support excitation, Vibration isolation, Transmissibility, Vibration measuring instruments, Displacement, velocity and acceleration measuring instruments	8	CO2
3	Introduction, Principal modes	Introduction, Principal modes, Introduction, Principal modes, Double pendulum Torsional system with damping, coupled system, dynamic vibration absorbers Dry friction damper, Dry friction damper.	8	CO3
4	Undamped free and forced vibrations	Undamped free and forced vibrations of multi-degree freedom systems influence number, Reciprocal theorem, Torsional vibration of multi-degree rotor system Vibration of gear system, Principal coordinates	8	CO4
5	Continuous systems- Longitudinal vibrations of bars	Continuous systems- Longitudinal vibrations of bars, Torsional vibrations of circular shafts, Torsional vibrations of circular shafts, Shaft with one disc with and without damping, Shaft with one disc with and without damping, Multi-disc shafts, Secondary critical speed	8	CO5

Reference Books:

Mechanical Vibrations – P. Srinivasan, TMH.

Mechanical Vibrations – G. K. Groover, Jain Brothers, Roorkee.

Mechanical Vibrations – W. T. Thomson.

Mechanical Vibrations – V. Rama Murthy, Narosa Publications

Mechanical Vibrations – Tse, Morse & Hinkle

e-Learning Source:

https://www.youtube.com/watch?v=bX_m53Xexvk&list=PLAC668A0566953FB5

https://www.youtube.com/watch?v=9r630K5HmJc&list=PLSGws_74K01_pG3R7rgtDtrDZBjcTgPdR

https://www.youtube.com/watch?v=IRfWDBMN4yU&list=PLbRMhDVUMngdM3vvYapHCEPTiEvoATCHS

https://www.youtube.com/watch?v=9t9qZMhnRFE

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1		2						3	1	2	2
CO2	3	3	3	2		3						3	3	3	2

CO3	2	1	3	3		1						2	2	2	1
CO4	3	1	3	1		2						3	2	2	1
CO5	3	2	2	1		1						2	3	2	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	ME411	**Title of the Course**	Heating Ventilation and Air Conditioning	**L**	**T**	**P**	**C**
Year	**IV**	**Semester**	VII	**3**	**1**	**0**	**4**
Pre-Requisite	RAC	**Co-requisite**	NONE				
Course Objectives	1. To Know about Human comfort requirement 2. Air conditioning system and its type 3. Central air conditioning system Vs unitary air conditioning system 4. Building services and BMS 5. Design and installation of central AC plant						

Course Outcomes	
CO1	Isolate the key features Air conditioning system
CO2	Indicate how the central AC plant works.
CO3	Describe the various aspect of human comfort
CO4	Differentiate between central Ac and Unitary Ac , Develop skill to manage installation site of air conditioning plant.
CO5	Estimate the total cost of any HVAC project Develop fundamental knowledge of the types of ventilation system and heating, cooling system.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Human Comfort	Human Comfort, requirements of comfort, comfort chart applied psychrometrics of air conditioning systems, components of A.C. System, Central and Unitary A.C. Systems, Industrial and human comfort air conditioning, Cogeneration of power and refrigeration	8	CO1
2	Heat transmission in buildings	Heat transmission in buildings, building survey and locations of equipment, considerations for heating and cooling loads, load calculation procedures	8	CO2
3	Air Transmission and distribution systems	Air Transmission and distribution systems, fans, pressure losses in ducts and duct sizing methods, Natural supply and extraction systems of ventilation and their combinations. Selection of Air distributions and extraction systems for ventilation, Air Cleaners and Scrubbers.	8	CO3
4	Fluid distribution System	Fluid distribution System; open loop & close loop, pipe sizing and layout, Hot water and Steam Heating Systems	8	CO4
5	A.C. Controls	A.C. Controls: Elements of basic control system, pneumatic, electric and electronic control, Thermostats and humidistat, Building-up of control system, Summer-Winter Changeover, Dampers, freeze protection, sequencing of operations, Temperature reset based on zone load.	8	CO5

Reference Books:

1. W.F. Stocker & J.w. Jones; Refrigeration & Air Conditioning, McGraw Hills Inc. Intl. Student'sEdition.
2. F.C. Quiston & Jerald J. Parker; HVAC Analysis & Design, John Wiley & Sons
3. HVAC Systems & Equipment, 1992, ASHRAE Handbook.
4. HVACFundamentals, 1993,ASHRAE Handbook.
5. Carrier's Handbook ofA.C. System, Design, Carrier D/c Co
6. C.P. Arora; Refrigeration and Air Conditioning, Tata McGraw Hill, New Delhi

e-Learning Source:

https://www.youtube.com/watch?v=xMkgzVR1Luo

https://www.youtube.com/watch?v=EK8l2zZ55wI

https://www.youtube.com/watch?v=nlsNmhiID74&list=PLfUUbFVTz-XcXbSUD0BXdPxGXFGkcdLXa

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	2	2	3					2	1	-	-
CO2	2	2	-	-	2	2	1					3	3	1	1
CO3	1	1	1	3	-	1	2					1	-	3	1
CO4	2	-	3	-	1	-	1					2	1	-	1
CO5	1	1	-	2	1	3	-					-	-	3	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	ME413	**Title of the Course**	Non Destructive Testing	**L**	**T**	**P**	**C**
Year	**IV**	**Semester**	VII	**3**	**1**	**0**	**4**
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	1.Importance of NDT in quality assurance 2. Introduction to Magnetic Particle Testing 3. Introduction to penetrant testing 4. Introduction to radiographic testing 5. Introduction to ultrasonic testing						

Course Outcomes	
CO1	Demonstrate basic concepts and importance of non-destructive testing and their application and also the understanding of commonly used NDT methods.
CO2	Understanding of Magnetism and Magnetizing devices and their properties its use in different magnetization techniques
CO3	Knowledge of aim and application areas of penetrant testing, test methods, types of penetrants and their properties
CO4	Understanding of properties of X and gamma rays and their generation and Radiographic exposure technique
CO5	Good knowledge of principles of wave propagation and working principle of ultrasonic testing techniques

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Scope and advantages of N.D.T	Scope and advantages of N.D.T. some common NDT methods used since ages-visual inspection, Ringing test, and chalk-test (oil-whiting test) their effectiveness in detecting surface cracks Modern NDT methods. Dye-penetrant test-principle, scope, equipment and techniques. Zyglo testing.	8	CO1
2	Magnetic Particle Inspection	Magnetic Particle Inspection. Scope of test, Principle equipment and technique. DC and AC magnetization, use of dry and wet powders testing. Interpretation of results	8	CO2
3	X-ray radiography	X-ray radiography – principle, equipment, and methodology. Interpretation of radiographs, limitations. Gamma ray radiography. Principle, equipment and technique. Precautions against radiation hazards, Advantage over x-ray radiography methods.	8	CO3
4	Introduction Principle of Operation-piezoelectricity and ultrasonic probes	Introduction Principle of Operation-piezoelectricity and ultrasonic probes, Cathode ray oscilloscope techniques, Advantages and limitations. Application of NDT method in the inspection of castings, forging and welded structures with illustrative examples.	8	CO4
5	Eddy Current Testing-	Eddy Current Testing- Introduction, Principle, Current Flow Characteristics, Eddy Current Instruments and Probes, Inspection of Tube, Crack Inspection	8	CO5

Reference Books:

1. P. Halmshaw; Non-Destructive Testing

2. Metals Handbook Vol. II, Non-destructive inspection and quality control.

e-Learning Source:

https://www.youtube.com/watch?v=5cNWF61Tmj0&list=PLyAZSyX8Qy5AePdV6vbGP4OJQOpbga-0Q

https://www.youtube.com/watch?v=uAI_APW3wHE&list=PL0gamkFKdFetno5660_dKeWdL9zjFVth8

https://www.youtube.com/watch?v=DK1dItnI8mM

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	2	1					3	3	2	3
CO2	3	3	3	2	2	3	1					2	3	3	2
CO3	3	3	2	2	2	3						2	3	2	3
CO4	3	2	2	2	3	3	1					2	3	3	2
CO5	3	1	1	1	1	3						2	3	2	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	ME414	**Title of the Course**	Fuel and Combustion	**L**	**T**	**P**	**C**
Year	IV	**Semester**	VII	**3**	**1**	**0**	**4**
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	1. To give the knowledge about different types of conventional and nonconventional fuels, their origins and properties. 2. To give them the basic understanding of combustion thermodynamics. 3. To equip students with the knowledge of chemical kinetics. 4. To give them an understanding of premixed and diffusion flames 5. To give them the knowledge about sources of pollutants produced during combustion, and its controlling methods						

Course Outcomes	
CO1	To give the knowledge about different types of conventional and nonconventional fuels, their origins and properties.
CO2	To give them the basic understanding of combustion thermodynamics.
CO3	To equip students with the knowledge of chemical kinetics.
CO4	To give them an understanding of premixed and diffusion flames
CO5	To give them the knowledge about sources of pollutants produced during combustion, and its controlling methods.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Fuels	**Fuels:** Types of fuels, structure of petroleum fuels, refining process, products of refining process, required properties of an ideal gasoline. Diesel fuels and its properties; flash point, fire point, cloud point, viscosity.	8	CO1
2	Ratings of fuels & Alternative fuels	**Ratings of fuels:** Rating of gasoline, Rating of diesel fuel; cetane no.,diesel index, API gravity and specific gravity. **Alernative fuels**: Petroleum fuels and non petroleum fuels; Benzol, alchohal, ammonia, biodiesel, biogas. Fuels for gas turbine and jet engines.	8	CO2
3	Fundamentals of Combustion	**Fundamentals of Combustion**: Conservation of mass to reacting system to determine balanced reaction equation, Stoichiometry of reactions; Enthalpies of formation reaction and combustion; Adiabatic flame temperature. **Types of combustion**: premixed burning, diffusion burning.	8	CO3
4	Flames & Chemical Kinetics	**Flames:** Laminar premixed flames; Burning velocity; Effect of Stoichiometry, pressure and temperature on burning velocity. **Chemical Kinetics**: Elementary Reactions, Reaction order and molecularity; Arrhenius law; Relation between rate coefficient and equilibrium constant; Chain reactions, Nitrogen oxides kinetics.	8	CO4
5	Pollutants from combustion	**Pollutants from combustion**: Pollutants from gasoline engine; evaporative loss, cranckcase blowby, tailpipe exhaust emission. gasoline engine emission control; fuel modification, engine design, treatment of exhaust gas. Diesel engine emission; constituents of diesel engine exhaust, types of diesel smokes; mechanism of smoke formation, and its control, diesel odour and its control.	8	CO5

Reference Books:

1.IC engine by M.L Mathur & R.P Sharma; Dhanpat Rai Publication.

2. IC engine by V. Ganesan; McGraw Hill.

3. Yunus Cengel; Engineering Thermodynamics; Tata Mc-graw Hill

4. Eastop and McConkey; Applied Thermodynamics; Pearson Education Asia.

5. An Introduction to Combustion: Concepts and Applications by Stephen R. Turns,McGraw Hill

e-Learning Source:

https://www.youtube.com/watch?v=Fyq4Q5yWDDU&list=PLyqSpQzTE6M927gXIZdVbbsyj9cmxam-b

https://www.youtube.com/watch?v=s57q7CiWrT8&list=PLQkLfoKWUaBkXSSe0vIxPeEHzd9khFbmQ

https://www.youtube.com/watch?v=svXe-svCEho&list=PLLf6O8XdGj00RTPIi8Gn0zXuaaZvcUDj4

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	2	1					3	3	2	3
CO2	3	3	3	2	2	3	1					2	3	3	2
CO3	3	3	2	2	2	3						2	3	2	3
CO4	3	2	2	2	3	3	1					2	3	3	2

CO5	3	1	1	1	1	3						2	3	2	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	ME421	**Title of the Course**	CAD & CAM LAB	**L**	**T**	**P**	**C**
Year	**IV**	**Semester**	VII	**0**	**0**	**2**	**1**
Pre-Requisite	ME421	**Co-requisite**					
Course Objectives	• To impart basic knowledge on Computer Aided Design methods and procedures. • Demonstrate different methods for geometric modeling in CAD. • To introduce the fundamentals of solid modeling. • To impart basic knowledge of CNC machine structures and part programming.						

Course Outcomes	
CO1	To demonstrate the application of Knuckle joint and DDA alogarithm using C++
CO2	To demonstrate the application C++ programing
CO3	To demonstrate the application of assembly drawing using design softwares and CNC programing
CO4	To demonstrate the working of CNC milling and lathe machine
CO5	To demonstrate the application C++ programming for Optimisation

Experiment No.	**Title of the Experiment**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Auto CAD	To draw the Knuckle joint using Auto CAD.	2	CO1
2	DDA algorithm	Write a program in C ++ for a line using DDA algorithm.	2	CO1
3	C++ Programming	Write a program in C ++ for drawing of circle of given radius.	2	CO2
4	C++ Programming 2D translation	Write a program in C ++ for drawing for 2D translation of line. Write a program in C ++ to optimize a given function.	2	CO2
5	Solid works	To make the part model, Assembly and Drawing of the Oldham coupling using Solid works.	2	CO3
6	Introduction of NC & CNC machines, Turning operations	Study on difference between ordinary machine and NC machine. Write a N C part program for a turning operation for a given problem.	2	CO3
7	NC part program for a drilling & Milling	Write a NC part program for a drilling operation for a given problem. Write N C part program for a milling operation for a given problem.	2	CO4
8	Optimize a given function	Write a program in C ++ to optimize a given function	2	CO5

e-Learning Source:

https://drive.google.com/drive/folders/1YDPwwHV8tBH9MAA3tOH33EEd2vtgpDnw?usp=share_link

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	3			3	2		3	3	2	2
CO2	3	3	2	3	2	3			3	2		3	3	2	2
CO3	3	3	2	3	2	3			3	2		3	3	2	2
CO4	3	3	2	3	2	3			3	2		3	3	2	2
CO5	3	2	2	2	2	3			2	2		3	3	2	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	ME422	**Title of the Course**	IC Engine and Automobile Engineering Lab	**L**	**T**	**P**	**C**
Year	IV	**Semester**	VII	0	0	2	1
Pre-Requisite	NA	**Co-requisite**	NA				
Course Objectives	The purpose of this course is to impart adequate knowledge in both practically and theoretically, covering the various types of power-driven vehicles and to familiarize the students with the fundamentals of Automotive Engine System, Chassis and suspension system, braking and transmission system, and cooling system. The students are acquainted with the operation, maintenance and repairs of all components of the various transportation vehicles.						

Course Outcomes	
CO1	List different types of Engine and their classifications.
CO2	Develop concept and define working of Automobile Engine cooling and lubrication system.
CO3	Describe functioning of Transmission train, conventional and non-conventional drives, Clutches, Gear boxes, Synchromesh device, Propeller shaft, Differential axle, braking system and Suspension systems.
CO4	Describe functioning of steering system, steering geometry wheel alignment and wheel angles for modern Automobile.
CO5	Describe starting system and electrical system

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Technical features of common scooters	Comparative study and technical features of common scooters and motorcycles available in India.	2	CO1
2	Technical features of common small cars	Comparative study and features of common small cars	2	CO1
3	Braking System	Study the working mechanism of braking system.	2	CO2
4	Steering System	Study the working mechanism of steering system.	2	CO2
5	Transmission System	Study the working mechanism of transmission system	2	CO3
6	Suspension System	Study the working mechanism of suspension system.	2	CO3
7	Lubrication and cooling system	Study the working mechanism of lubrication and cooling system.	2	CO4
8	MPFI system.	Study the working mechanism of MPFI system.	2	CO5
e-Learning Source:				
https://www.youtube.com/watch?v=C__h8fLQbOE				

	Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO4
CO1	3	3	2	3	2	3			3	2		3	3	2	2
CO2	3	3	2	3	2	3			3	2		3	3	2	2
CO3	3	3	2	3	2	3			3	2		3	3	2	2
CO4	3	3	2	3	2	3			3	2		3	3	2	2
CO5	3	2	2	2	2	3			2	2		3	3	2	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**