



Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore
Shri Vaishnav Institute of Technology and Science
Choice Based Credit System (CBCS) Scheme in light of NEP2020
B. Tech in Automobile Engineering
(2024 - 2028)

COURSE CODE	CATE GORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTAU702	DE	HYBRID AND ELECTRIC VEHICLES	60	20	20	0	0	3	0	0	0

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):

Students will be able to (A) understand of electric and hybrid vehicle technology, including the historical background, current state, and future prospects. (B) Develop a broader awareness of electric and hybrid vehicle applications, (C) contributing to the advancement of clean and sustainable transportation solutions.

Course Outcomes (COs):

Students are expected to be able to:

1. Grasp the principles and technologies behind electric and hybrid vehicle propulsion systems, including energy storage solutions and motor torque calculations.
2. Acquire the skills to design electric vehicle architectures and integrate various components for optimal performance.
3. Demonstrate competence in electric drive and controller design, contributing to the development of efficient and sustainable electric and hybrid vehicles.
4. Evaluate battery management system requirements and implement strategies to enhance battery life and safety in electric vehicles.

Syllabus

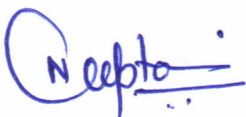
Unit – I

Introduction: History, Components of electric vehicle, Comparison with internal combustion engine: Technology, Comparison with internal combustion engine: Benefits and challenges, EV classification and their electrification levels. EV terminology.

Life Cycle Assessment (LCA) of Vehicles: Introduction, Life Cycle Stages, Environmental Impact Assessment, Raw Material Extraction, Manufacturing, Operation, Maintenance, End-of-Life Disposal and Recycling.

Unit – II

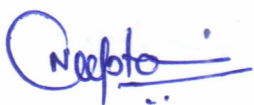
Energy Storage Solutions (ESS): Cell Types (Lead Acid/Li/NiMH), Battery charging and discharging calculation, Cell Selection and sizing, Battery lay outing design, Battery pack configuration, Battery pack construction, Battery selection criteria.



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Motor Torque Calculations for Electric Vehicle: Calculating the rolling resistance, calculating the grade resistance, calculating the acceleration force, finding the total tractive effort, torque required on the drive wheel.

Unit – III

Electric Vehicle Architecture Design: Types of electric vehicle and components, Electrical protection and system requirement, Photovoltaic solar based EV design, Battery Electric vehicle (BEV), Hybrid electric vehicle (HEV), Plug-in hybrid vehicle (PHEV), Fuel cell electric vehicle (FCEV), Electrification Level of EV, Comparison of fuel vs electric and solar power, Solar power operated electric vehicles, Case study.

Unit – IV

Electric Drive and controller: Types of motors, Selection and sizing of motor, RPM and torque calculation of motor, Motor Controllers, Component sizing, Physical locations, Mechanical connection of motor, Electrical connection of motor.

Unit – IV

Battery Management System Requirement: Introduction and BMS functionality, Battery pack topology, Voltage Sensing, Temperature Sensing, Current Sensing, High-voltage contactor control, Isolation sensing, Thermal control, Protection, communication interface, Range estimation, State-of-charge estimation, Cell total energy and cell total power.

Indian and Global Scenario: Technology Scenario, Market Scenario, Policies and Regulations, Payback and commercial model, Policies in India.

Text & Reference Books:

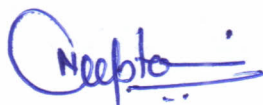
1. "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design" by M. Ehsani, Y. Gao, S. Gay and Ali Emadi; Publisher: CRC Press, 2005
2. "Electric and Hybrid Vehicles: Design Fundamentals" by Iqbal Husain; Publisher: CRC Press, 2003.



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3. "Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles" by Sheldon S. Williamson; Springer, 2013.
4. "Modern Electric Vehicle Technology" by C.C. Chan and K.T. Chau; Publisher: OXFORD University Press, 2001
5. "Hybrid Electric Vehicles Principles and Applications with Practical Perspectives" by Chris Mi, M. Abul Masrur, David Wenzhong GAO; Publisher: Wiley Publication, 2011.
6. "Electric Vehicle Technology Explained" by James Larminie, John Lowry Wiley, 2003.
7. "Battery management systems, Volume I: Battery modeling by Plett, Gregory L. Artech House, 2015.
8. "Battery management systems, Volume II: Equivalent-circuit methods by Plett, Gregory L. Artech House, 2015.
9. "Battery Management Systems - Design by Modelling" by Bergveld, H.J., Kruijt, W.S., Notten, P.H.L Philips Research Book Series 2002.

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BTAU701C	DE	COMBUSTION AND HEAT TRANSFER	60	20	20	0	0	3	0	0	3

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

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Course Educational Objectives (CEOs)

Students (A) will be able to familiarize with combustions in IC engines, (B) students will understand the heat transfer fundamentals in IC Engines, (C) students will be able to solve problems related to heat transfer.

Course Outcomes (COs)

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes, the students will be able to

1. Apply knowledge of combustion and heat transfer on S.I. and C.I. engines.
2. Solve/describe the problems related to heat transfer by conduction.
3. Solve/describe the problems related to heat transfer by convection.
4. Demonstrate Heat transfer from extended surface, steady flow of heat along a rod.

Syllabus

Unit-I

Combustion: Combustion phenomena of S.I. and C.I. engines, Stages of combustion, Photographic studies of combustion process- p-q diagrams in S.I. and CI engines. Abnormal combustion-Effect of engine variables on knock-Factors controlling combustion chamber design. Combustion chambers: Diesel engine combustion chambers open, Divided, Swirl, Turbulent and Ricardo's M Combustion chambers.

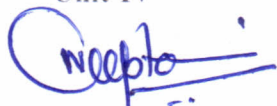
Unit-II

Heat Transfer in IC engines: Heat transfer, Temperature distribution and thermal stress in Piston, Cylinder Liner, cylinder head, Fins and valves. Variation of gas temperatures; Heat transfer coefficient and combustion system-Effect of engine load on piston temperature heat rejected to coolant quantity of water required.

Unit-III

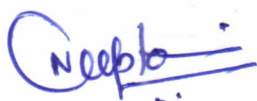
Introduction to heat transfer: Temperature, Heat and thermal equilibrium, Modes of basic laws of heat transfer i.e., conduction, Convection and Radiations; Fourier equation and Thermal Conductivity, Derivation of the general form of heat conduction equation in Cartesian, Cylindrical Spherical Coordinates.

Unit-IV



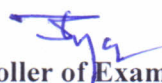
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Conduction Heat Transfer: Steady State Conduction, Heat conduction through plane wall, Composite wall, cylindrical wall, Multi-layer cylindrical wall, and through spheres; effect of variable conductivity, Critical thickness of Insulation; conduction with heat generation, plane wall with uniform heat generation, Dielectric heating, Cylinder with uniform heat generation, Heat transfer from extended surface, Heat dissipation from and infinitely long fin, Fin performance.

Unit-V

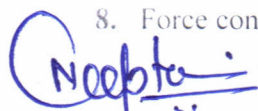
Convection Heat Transfer: Free and forced convection, Laminar and Turbulent flow, Newton-Rehman Law: Convection rate equation, Nusselt Number; radiation heat exchanger; salient features and characteristics of radiation, Absorptive, reflectivity and transmittance; spectral and spatial energy distribution, wavelength distribution of black body radiation, Plank's law; total emissive power: Stefan Boltzman law, Wien's displacement law, Kirchoffs Law, gray body and selective emitters.

Reference Books:

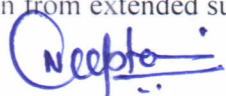
1. "Internal Combustion Engine Fundamentals", by J.B. Heywood, McGraw-Hill, 1995.
2. "Fundamentals of Internal Combustion Engines", by Paul W. Gill & James H. Smith, Oxford & IBH Pub. Ltd., 1992.
3. "A Course in Internal Combustion Engines", by V. M. Domkundwa, Dhanpat Rai Publication, 2013.
4. "Internal Combustion Engines", by V. Ganesan, Tata McGraw-Hill, 2nd edition, 2012.
5. "Heat and mass transfer" by Sukhatme SP, University Press Hyderabad, 2005.
6. "Heat transfer" by Holman JP, TMH, 2011
7. "Heat and Mass Transfer" by Nag PK, TMH, 2007.
8. "Heat Transfer Principles and App, by Dutta BK, PHI Learning, 2015.

List of experiments (please expand it);

1. Study the combustion phenomena of S.I. and C.I. engines.
2. Conduction through a rod to determine thermal conductivity of material.
3. Forced and free convection over circular cylinder.
4. Free convection from extended surfaces.
5. Parallel flow and counter flow heat exchanger effectiveness and heat transfer rate
6. Calibration of thermocouple.
7. Experimental determination of Stefan Boltzmann constant.
8. Force convection from extended surfaces.



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BTME701C	DSE	INDUSTRIAL AUTOMATION AND PRODUCTION SYSTEM	60	20	20	0	0	3	0	0	3

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

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Course Educational Objectives (CEOs):

This course provides knowledge of (A) Industrial Automation, technologies and (B) its application with Production system.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes, the students will be able to

1. To identify potential areas for automation and justify need for automation.
2. To select suitable major control components required to automate a process or an activity.
3. To translate and simulate a real time activity using modern tools and discuss the benefits of automation.
4. To identify suitable automation hardware for the given application.
5. To recommend appropriate modeling and simulation tool for the given manufacturing application.

Syllabus

Unit-I

(8 Hrs)

Introduction: Automation in Production System, Principles and Strategies of Automation, Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automations. Flow lines & Transfer Mechanisms, Fundamentals of Transfer Lines. (SLE: Analysis of Transfer Lines)

Unit – II

(9 Hrs)

Material handling and Identification Technologies: Overview of Material Handling Systems, Principles and Design Consideration, Material Transport Systems, Storage Systems, Overview of Automatic Identification Methods. (SLE: Material Identification Methods).

Unit – III

(9 Hrs)

Control Technologies in Automation: Industrial Control Systems, Process Industries versus Discrete-Manufacturing Industries, Continuous Versus Discrete Control, Computer Process and its Forms. (SLE: Sensors, Actuators and other Control System Components).

Unit – IV

(9 Hrs)

Computer Based Industrial Control: Introduction& Automatic Process Control, Building Blocks of Automation Systems: LAN, Analog & Digital I/O Modules and SCADA Systems & RTU.

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BTME701C	DSE	INDUSTRIAL AUTOMATION AND PRODUCTION SYSTEM	60	20	20	0	0	3	0	0	3

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Distributed Control System: Functional Requirements, Configurations & some popular Distributed Control Systems. (SLE: Display Systems in Process Control Environment.)

Unit – V (10 Hrs)

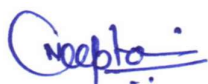
Assembly Lines: Fundamentals of Manual Assembly Lines, Alternative Assembly Systems, Design for Assembly, Analysis of Single Model Assembly Lines. Line balancing problem, largest candidate rule, Ki Bridge and Wester method, and Ranked Positional Weights Method, Mixed Model Assembly Lines, Considerations in assembly line design. Transfer lines, Fundamentals of Automated Production Lines, Storage Buffers, and Applications of Automated Production Lines.

Textbooks:

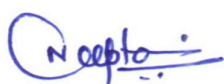
1. "Automation, Production Systems and Computer Integrated Manufacturing" by M. P. Groover, Pearson Education, 2024.
2. "Industrial Automation and Robotics" by A. K. Gupta and S. K. Arora, Mercury Learning & Information, Latest Edition
3. "Industrial Automation and Process Control" by Jon Stenerson, Pearson Education, Latest Edition.
4. "Programmable Logic Controllers" by Frank D. Petruzella, McGraw-Hill Education, 5th Edition, 2021.
5. "Computer Based Industrial Control" by Krishna Kant, EEE-PHI, 2nd edition, 2010.

Reference Books:

1. "Computer Integrated Manufacturing" by James A. Rehg and Henry W. Kraebber, Pearson Education, 3rd Edition.
2. "SCADA: Supervisory Control and Data Acquisition" by Stuart A. Boyer, International Society of Automation (ISA), 4th Edition.
3. "Programmable Logic Controllers" by W. Bolton, Newnes (Elsevier), 6th Edition, 2015.
4. "Industrial Robotics: Technology, Programming, and Applications" by Mikell P. Groover, Mitchell Weiss, Roger N. Nagel, and Nicholas G. Odrey, McGraw-Hill Education, Latest Edition.
5. "Process Control: Principles and Applications" by Surekha Bhanot, Oxford University Press, Lat Edi.
6. "Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering" by W. Bolton, Pearson Education, Latest Edition.



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BTAU703	DCC	VEHICLE DYNAMICS	60	20	20	30	20	3	1	2	5

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs)

This course provides a fundamental understanding of (A) Vehicle handling and ride performance through the development (B) Analysis and critical interpretation of vehicle/system models.

Course Outcomes (COs)

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

1. Students will be able to understand the Performance Characteristics and Aerodynamics of vehicle.
2. Students will be able to identify the various forces and loads and performance under acceleration, ride and braking.
3. Students will be able to solve the fundamental problems in vehicle dynamics.

Syllabus

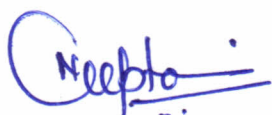
Unit – I

Performance Characteristics of Vehicle: SAE Vehicle axis system, Forces & moments affecting vehicle, Earth Fixed coordinate system, Dynamic axle loads, Equations of motion, transmission characteristics, vehicle performance, power limited and traction limited acceleration, braking performance, Brake proportioning, Braking efficiency.

Aerodynamics: Mechanics of Air Flow around a Vehicle, Pressure Distribution on a Vehicle, Aerodynamic Forces, Drag Components, Aerodynamics Aids.

Unit – II

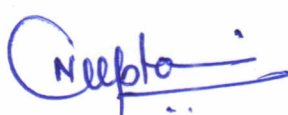
Tire Mechanics: Tire Construction, Size and Load Rating, Terminology and Axis System, Tractive Properties, Cornering Properties, Camber Thrust, Aligning Moment, Combined Braking and Cornering, Conicity and Ply Steer, Slip, Skid, Rolling Resistance, Elastic Band Model for longitudinal slip, Simple model for lateral slip, Combined longitudinal/lateral slip (friction ellipse), Taut string model for lateral slip, Magic Tire Formula.



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BTAU703	DCC	VEHICLE DYNAMICS	60	20	20	30	20	3	1	2	5

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Unit – III

Suspensions: Suspension Kinematics, Suspension types, Solid Axles, Independent Suspensions, Anti-Squat and Anti-Pitch Suspension Geometry, Anti-Dive Suspension Geometry, Roll Center Analysis, Suspension Dynamics, Multi-body vibration, Body and Wheel hop modes, Invariant points.

Unit – IV

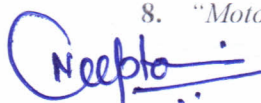
The Steering System: The Steering Linkages, Steering System Forces and Moments, Steering System Models, Steering Geometry, Steady Handling (2 DOF steady state model), Under-steer and Over-steer, Effect of Tire Camber and Vehicle Roll (3 DOF steady-state model), Transient Handling and Directional Stability (2 DOF unsteady model), Effect of Vehicle Roll on Transient Handling (3 DOF unsteady model), Steady-State and Transient Handling of Articulated Vehicles.

Unit-V

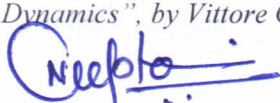
Motorcycle Dynamics: Kinematic structure of motorcycle, geometry of motorcycles, importance of trail, Resistance forces acting on motorcycle (tyre rolling resistance, aerodynamic resistance forces, resistant force caused by slope), Location & height of motor cycle's centre of gravity (C.G), Moments of inertia on Motorcycle; Introduction to Front & Rear suspensions of Motorcycle.

Reference Books:

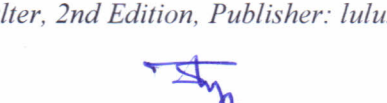
1. "Vehicle dynamics", by R.V. Dukkipati, Narsova Publications, 2012.
2. "Fundamentals of Vehicle dynamics", by Thomas D Gillespie, SAE USA, 1992.
3. "Vehicle Dynamics & control", by Rajesh Rajamani, Springer, 2011.
4. "Theory of Ground Vehicles", by Wong J Y, John Wiley & Sons, New York, 1978
5. "Race car Vehicle Dynamics", by Milliken W F and Milliken D L, SAE, 1997.
6. "Motor Vehicle", by Garrett T K, Newton K and Steeds W, Butter Worths & Co., Publishers Ltd., New Delhi, 2001.
7. "Vehicle and Engine Technology", by Heinz Heister, SAE Second Edition, 1999
8. "Motorcycle Dynamics", by Vittore Cossalter, 2nd Edition, Publisher: lulu.com, 2006.


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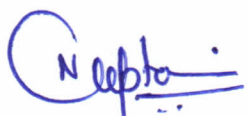
COURSE CODE	CATEG ORY	COURSE NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTAU703	DCC	VEHICLE DYNAMICS	60	20	20	30	20	3	1	2	5

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

List of Experiments

1. Experimental study of mechanism for air flow over different geometry of vehicles.
2. Experimental studies of measurements of drag and lift coefficient for different geometry vehicle using wind tunnel apparatus.
3. To study the effect of tyre pressure and temperature on the performance of the tyre.
4. Finding the stiffness of tyre with variation of air pressure.
5. To simulate and study the effect of different conditions on vehicle loading.
6. Study of latest technologies available nowadays in vehicles helping to maintain stability of the vehicle on the road.
7. Study geometry of motorcycles as well as various types of forces faced by the motorcycle & its rider.
8. Study the location & height of Centre of gravity (C.G) of a motorcycle.


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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTAU704	DSE	AUTOMOTIVE AIR CONDITIONING	60	20	20	30	20	3	0	2	4

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):

The objective of the course is to describe (A) Automotive AC fundamentals, (B) Automotive Cooling and Heating System, (C) AC controls and Automatic Temperature control (D) AC Maintenance and service.

www

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes -

1. Students would be able to understand the automotive air-conditioning fundamentals.
2. Students would be able to understand basics of refrigerants and its handling.
3. Students would be able to understand automotive cooling and heating system.
4. Students will be able to understand and describe various control systems.
5. Students would be able to maintenance and servicing of Automotive AC system.

Syllabus

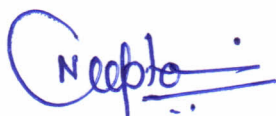
Unit - I

Automotive Air-conditioning Fundamentals: purposes of heating, ventilation and air conditioning in automobiles; environmental concerns: ozone layer depletion, location of air conditioning components in a car: schematic layout of a vehicle refrigeration system, major components: -compressor, condenser and high-pressure service valve, thermostatic expansion valve, evaporator, controlling evaporator temperature. Psychrometry: basic terminology and psychrometric mixtures, psychrometric chart related problems.

Unit - II

Refrigerants

Classification of refrigerants, coding of refrigerants, desirable properties of refrigerants, substitutes for CFC refrigerants, containers, refrigerant handling: discharging, charging & leak detection, refrigeration system diagnosis: diagnostic procedure, ambient conditions affecting system pressures. Thermodynamic cycles, coefficient of performance,



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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTAU704	DSE	AUTOMOTIVE AIR CONDITIONING	60	20	20	30	20	3	0	2	4

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Unit – III

Automotive Cooling and Heating System

Types of compressors: compressor clutches, compressor clutch electrical circuit, compressor lubrication; condensers, evaporators, expansion devices, evaporator temperature and pressure controls, receiver, drier, accumulators, refrigerant hoses. Automotive heaters, manually controlled air conditioner and heater system, automatically controlled air conditioner and heater systems.

Unit – IV

AC Controls and Automatic Temperature Control

Types of control devices: preventing compressor damage, preventing damage to other systems, preventing overheating. Ram air ventilation: air delivery components, control devices, vacuum controls. Automatic temperature control: different types of sensors and actuators.

Unit-V

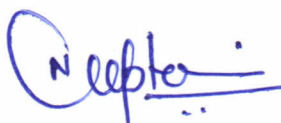
Maintenance and Service

Air conditioner maintenance and service, inspection using manifold gauge, servicing heater system, removing and replacing components, evacuation and refilling of refrigerant, trouble shooting of air controlling system, servicing of compressor, Safety devices: air conditioning protection & engine protection.

Note: Data Book and data tables are allowed in the examination hall as per instruction of exam cell.

Reference Books:

1. "Automotive Heating, Ventilation, and Air Conditioning systems" by Warren Farnell and James D. Halderman, Classroom Manual, Pearson Prentice Hall, 2004



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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTAU704	DSE	AUTOMOTIVE AIR CONDITIONING	60	20	20	30	20	3	0	2	4

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

2. "Automotive Air conditioning" by William H. Crouse and Donald I. Anglin, McGraw-Hill, 1995.
3. "Refrigeration and Air Conditioning", by C. P. Arora, Tata McGraw Hill, 2006.
4. "Refrigeration and Air Conditioning Technology", by Whitman, Jhonson and Tomczyk, Thomson Delmer Learning, 1992.
5. "Refrigeration and Air Conditioning", by Abdul Ameen, Prentice Hall of India Ltd, 2006.
6. "Refrigeration and Air Conditioning", by Wilbert F. Stoecker and Jerold W. Jones, Tata McGraw Hill, 2008.
7. ASHRAE Handbook – Refrigeration 2010,
8. "Refrigeration and Air Conditioning" by G S Sawhney, valu education of India, 2015.

List of Experiments:

1. To study the layout of car air conditioning system and its components.
2. To study the properties of different refrigerants.
3. To study different types of compressors used in automotive AC.
4. To study automatically controlled air conditioner and heater systems.
5. To study various control devices used in automotive AC system.
6. To study various sensors and actuators used for automatic temperature control.
7. To study common practice used for maintenance of car AC system.

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COURSE CODE	CATE GORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTME708	DCC	INDUSTRIAL ENGINEERING	60	20	20	0	0	3	0	0	3

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):

This course provides the knowledge of (A) concepts of industrial engineering (B) Production Planning, Inventory, Six Sigma.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

1. Students would be able to understand concepts of production planning and inventory control in an industry.
2. Students would be able to understand productivity management.
3. Students would be able to understand plant Layout & Material handling equipment's.
4. Students will be able to understand and gain the knowledge of six sigma & lean manufacturing.

Syllabus

Unit-I

(8 Hrs)

Introduction to Industrial Engineering

Industrial engineering concepts, Work Study, Method study, Motion economy and analysis, Work measurement,

Production Planning and Control: Definition and importance, types of production -job, batch and mass, forecasting, routing, scheduling, dispatching and follow up. Break even analysis and Gantt chart Project.

Unit-II

(10 Hrs)

Productivity Management: Concept of Productivity, Factors affecting Productivity, Total productivity model. Short term and long term Productivity Planning Models. Productivity improvement Techniques: Technology based, Material based, Employee based, Product and Time based P.I. Techniques

Unit-III

(8 Hrs)

Plant Location and Layout: Definition, factors affecting the site selection of plant Factor affecting plant layout Types of layout - process, product, combination and fixed position layout Techniques in



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BTME708	DCC	INDUSTRIAL ENGINEERING	60	20	20	0	0	3	0	0	3

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

making layout-Flow diagram, templates, distance volume matrix, travel chart, Line balancing, workstation, Basic location decision models- factor rating method, weighted factor rating method, load distance method, centre of gravity method; Material Handling systems

Unit-IV (8 Hrs)

Inventory Control: Definition, types of inventory - Codification and standardization ABC analysis. Economic ordering quantity Procurement cost, carrying charges, lead-time, re-order point, simple problems. Definitions, types of inspection and procedure Statistical quality control - Basic theory of quality control.

Unit-V (9 Hrs)

Lean Manufacturing & Six Sigma: Introduction, Lean - Evolution & Steps, Introduction to Lean Manufacturing, Lean - Specify Value - Quality at Source, 5S Concepts, 5S Implementation, Identify Value Stream - Process Mapping, Inventory bad, Process Layouts, Lean - Make It Flow - Setup Time Reduction, Hejunka, Total Productive Maintenance. Electrostatic Discharge (ESD) Management: Fundamentals of ESD, ESD control methods, workplace safety, and defect reduction in lean manufacturing.

Six Sigma: Overview, Six Sigma (basics and history of the approach, methodology and focus), the application of Six Sigma in production and in service industries, Relationship of Six Sigma and Lean Management, linking Six Sigma project goals with organizational strategy.

Text and References Books:

1. Barnes Ralph M., "Motion & Time study: Design and Measurement of Work", Wiley Latest Edition.
2. Mukhopadhyay S.K, "Production Planning and Control: Text and Casesby", PHI, 2015.
3. Dr. R.K. Singal, "Production Planning and Control" by, Katson Books, 2014.
4. Narasimhan & Seetharama L, "Production Planning and Inventory Control", PHI, 2015.
5. E. Rich and K. Knight, "Artificial Intelligence", Tata McGraw Hill, 2009.
6. G. J. Klir and B. Yuan, "Fuzzy sets and Fuzzy Logic Theory and Applications", Prentice Hall Inc. NJ. 2008.
7. Jeffrey K. Liker, "Becoming Lean - Inside Stories of U.S. Manufacturers", Productivity Press, Portland, Oregon, 2005.



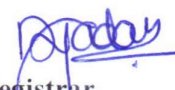
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BBA - III SEMESTER (2025-2029)

BBAI501 HUMAN VALUES AND PROFESSIONAL ETHICS

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BBAI501	AECC	Human Values and Professional Ethics	60	20	20	-	-	4	-	-	4

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical: C - Credit; AECC- Ability Enhancement Compulsory Course

***Teacher Assessment** shall be based on following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objective

The objective of the course is to disseminate the theory and practice of moral code of conduct and familiarize the students with the concepts of “right” and “good” in individual, social and professional context

Examination Scheme

The internal assessment of the students’ performance will be done out of 40 Marks. The semester Examination will be worth 60 Marks. The question paper and semester exam will consist of two sections A and B. Section A will carry 36 Marks and consist of 5 questions, out of which student will be required to attempt any three questions. Section B will comprise of one or more cases / problems worth 24 marks.

Course Outcomes

1. Help the learners to determine what action or life is best to do or live.
2. Right conduct and good life.
3. To equip students with understanding of the ethical philosophies, principles, models that directly and indirectly affect business.

COURSE CONTENT

UNIT I: Human Value

1. Definition, Need for Human Values, Sources of Values
2. Essence of Values
3. Classification of Values (Temporal Values, Universal Values)
4. Values Across Culture

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BBA - III SEMESTER (2025-2029)

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BBAI501	AECC	Human Values and Professional Ethics	60	20	20	-	-	4	-	-	4

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; AECC- Ability Enhancement Compulsory Course

***Teacher Assessment** shall be based on following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

UNIT II: Morality

1. Morality its meaning and definition
2. Values Vs Ethics Vs Morality
3. Concept of Impression Management
4. Impression Management Strategies (Intimidation, Ingratiation, Self-promotion, Supplication, Exemplification)

UNIT III: Leadership in Indian Ethical Perspective.

1. Leadership, Pre-requisites of Leadership
2. Approaches to Leadership, Leadership Styles
3. Ethical Leadership
4. Values in Leadership

UNIT IV: Business Ethics

1. Business Ethics its meaning and definition
2. Relevance of Ethics in Business organizations.
3. Theories of Ethics (Teleological, Deontological)
4. Code of Ethics

UNIT V: Globalization and Ethics

1. Globalization and Business Changes
2. Values for Global Managers
3. Corporate Social Responsibility
4. Benefits of Managing Ethics in Work Place.

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COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME								
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BBAI501	AECC	Human Values and Professional Ethics	60	20	20	-	-	4	-	-	4

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; AECC- Ability Enhancement Compulsory Course

*Teacher Assessment shall be based on following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Suggested Readings:

1. Kaur, T. (2004). *Values and Ethics in Management*. Galgotia Publishing Company: New Delhi
2. Kaushal, S.L. (2006). *Business Ethics. Concepts, Crisis and Solutions*. Deep & Deep Publications Pvt. Ltd.: New Delhi
3. Beteille, Andre (1991). *Society and Politics in India*. AthlonePress: New Jersey.
4. Chakraborty, S. K. (1999). *Values and Ethics for Organizations*. Oxford University Press
5. Fernando, A.C. (2009). *Business Ethics - An Indian Perspective*. India: Pearson Education: India
6. Fleddermann, C. D. (2012). *Engineering Ethics*. New Jersey: Pearson Education / Prentice Hall.
7. Boatright, J.R. (2012). *Ethics and the Conduct of Business*. Pearson. Education: New Delhi.
8. Crane, A.and Matten, D. (2015). *Business Ethics*. Oxford University Press Inc:New York.
9. Murthy, C.S.V. (2016). *Business Ethics – Text and Cases*. Himalaya Publishing House Pvt. Ltd:Mumbai
10. Naagrajan, R.R (2016). *Professional Ethics and Human Values*. New Age International Publications: New Delhi.

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BTAU706	SEC	CFD (COMPUTATIONAL FLUID DYNAMICS) LAB	0	0	0	0	50	0	0	2	1

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs)

To develop the ability to apply numerical methods and CFD techniques for analyzing fluid flow problems, evaluate the accuracy and stability of numerical solutions, and interpret simulation results using modern CFD tools.

Course Outcomes (COs)

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes students will be able

1. Explain the fundamentals, applications, and importance of Computational Fluid Dynamics (CFD).
2. Apply governing equations and discretization methods to model fluid flow problems.
3. Solve potential flow problems and linear systems using numerical techniques.
4. Analyze compressible Euler equations using upwind schemes and Riemann solvers.
5. Apply numerical methods to solve compressible Navier–Stokes equations for viscous flow and heat transfer.

Syllabus

Unit - I

Introduction: Introduction to Computational Fluid Dynamics, Need of CFD, Uses of CFD, Application and Recent Scenario.

Unit - II

Governing Equations and Discretization / Integration Fundamentals: Compressible Navier-Stokes / Euler equations, Incompressible Navier-Stokes / Euler equations, Potential equations Cartesian Grids, structured grids, and unstructured grids, Finite difference, finite volume, finite element, and Discontinuous Galerkin methods.

Unit - III

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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTAU706	SEC	CFD (COMPUTATIONAL FLUID DYNAMICS) LAB	0	0	0	0	50	0	0	2	1

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Numerical solution of the potential equations: Potential equations, Finite element methods, Numerical solution of a linear system.

Unit – IV

Numerical solution of the compressible Euler equations: Mathematical properties of the Euler equations, Discontinuous Galerkin (DG) finite element methods. Upwind methods: Upwinding for a scalar equation. Flux-Vector Splitting (FVS) methods, Low-diffusion FVS schemes, Godunov's exact Riemann solver. Roe's approximate Riemann solver, Boundary conditions.

Unit-V

Numerical solution of the compressible Navier-Stokes equations: Discretization of viscous and heat conduction terms, Bassi-Rebay method, Local discontinuous Galerkin method, Inter-cell reconstruction method.

Reference Books:

1. "Numerical Computation of Internal and External Flows", by Hirsch, C., 2nd ed., Butterworth-Heinemann, 2007, ISBN 9780750665940 (E-Book available).
2. "Computational Fluid Mechanics and Heat Transfer", by Pletcher, R. H., Tannehill, J. C., Anderson, D., 3rd ed., CRC Press, 2011, ISBN 9781591690375.
3. "Fundamentals of Engineering Numerical Analysis", by Moin, P., 2nd ed., Cambridge University Press, 2010, ISBN 9780521805261.
4. "Numerical Methods for Engineering Application", by Ferziger, J. H., 2nd ed., Wiley, 1998.
5. "Computational Methods for Fluid Dynamics", by Ferziger, J. H., Peric, M., 3rd ed., Springer, 2002.

List of Experiments

1. Introduction to CFD and ANSYS Fluent software.

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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTAU706	SEC	CFD (COMPUTATIONAL FLUID DYNAMICS) LAB	0	0	0	0	50	0	0	2	1

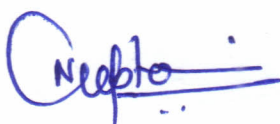
Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

2. Solution of the one-dimensional wave equation using the Explicit Finite Difference Method (Code Development).
3. Solution of the one-dimensional heat conduction equation using the Explicit Finite Difference Method (Code Development).
4. Generation of a simple algebraic grid (Code Development).
5. Study of boundary conditions and mesh generation in ANSYS Fluent.
6. Numerical simulation of laminar flow through a circular pipe.
7. Numerical simulation of flow over a flat plate.
8. Numerical simulation of flow past a circular cylinder.
9. Numerical simulation of flow over an airfoil.
10. Mini project: CFD analysis of a simple engineering problem using ANSYS Fluent.



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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTME705	PW/I	MINOR PROJECT	0	0	0	60	40	0	0	4	2

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***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):

Students obtain a hands-on experience by converting a small novel idea/technique into a working model/prototype or analysis etc. applying multi-disciplinary skills and / or knowledge and working in at team/individual.

Course Outcomes (COs):

At the end of the course, student will be able-

1. To conceptualise a novel idea / technique into a product.
2. To think in terms of multi-disciplinary environment and apply it.
3. To apply multi- disciplinary technical knowledge into project.
4. To take on the challenges of teamwork, prepare a presentation in a professional manner, and document all aspects of design/carried out work.

Syllabus

A multidisciplinary project is to be taken up by a team/individual (as per the university guidelines). Development of prototype product, a 3D model, simulation, analysis of particular technical problem etc. blueprint for a larger project and any other development work are permitted. The contribution of the individuals in the project should be clearly brought out. Individual /combined report may be submitted. Also, a presentation* will be taken to review/evaluate* the project work done by the candidate.

*Review or evaluation/ report preparation/presentation will be as per guidelines of university/institute/head.

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BTME709	PW/I	INDUSTRIAL TRAINING	0	0	0	0	50	0	0	4	2

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***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objective of Industrial Training:

The objective of this course industrial training is to provide work experience so that student's engineering knowledge is enhanced and employment prospects can improved in branch specific domain. The student should take this course as a window to the real world exposure and should try to learn as much as possible from real life experiences by involving and interacting with industry staff. Industrial training also provides an opportunity to students to select an Engineering problem. This training is also very helpful for Industry Internship/Major Project (VIII semester).

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

1. Learn and familiar with industry working culture and real-world exposure
2. Understand and gain knowledge of industrial processes, drawing, quality, tools maintenance, industrial technologies etc. related documentation and work.
3. Understand and gain knowledge of industry layout, processes, conventional manufacturing technologies and new technologies, quality control, maintenance of machines etc.

Scheme of Studies:

Duration: 2 or 3 weeks training in summer after VI semester examinations and (*Complete before commencement of VII semester*) assessment to be done in VII semester. *Training should be done in discipline/branch specific industry or related domain.*

Examination Scheme: -

For the assessment of industrial training undertaken by the students, following components may be considered with their weightage.

(a) Work in Industry

Attendance and General Discipline: -

Daily diary Maintenance: -

Initiative and participative attitude during training: -

Remark/Assessment of training by Industrial Supervisor (if any/required)

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BTME709	PW/I	INDUSTRIAL TRAINING	0	0	0	0	50	0	0	4	2

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(b) Practical/Oral Examination (Viva-Voce) in Institution

1. Training Report
2. Seminar and Viva-Voce

*During training students will prepare a first draft of training report in consultation with section in-charge. After training they will prepare final draft with the help of T.P.O. /Faculty of the Institute. Then they will present a seminar on their training and they will face viva-voce on training in the Institute. *Change in evaluation may be possible and the decision of Head/concerned authority will be final.*

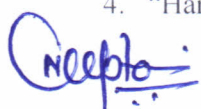
Learning through industrial training:

During industrial training students must observe following to enrich their learning Industrial environment and work culture.

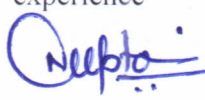
1. Organizational structure and interpersonal communication.
2. Machines/equipment/instrument-their working and specifications.
3. Manufacturing, process, product development procedure and phases etc.
4. Project Planning, monitoring and control.
5. Quality control and assurance.
6. Maintenance system
7. Costing system
8. Stores and purchase systems.
9. Layout of Computer/EDP/MIS centers.
10. Roles and responsibilities of different categories of personnel.
11. Customer services.

Students are supposed to acquire the knowledge above by:

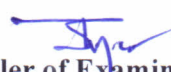
1. Direct Observations without disturbing personnel at work.
2. Interaction with officials at the workplace in free/ teatime.
3. Study of Literature at the workplace (e.g. User Manual, processes, schedules, etc.)
4. "Hand's on" experience

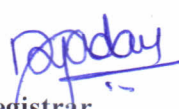

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5. Undertaking/assisting project work, manufacturing process, R&D, quality control etc.
6. Solving problems at the workplace.
7. Presenting a seminar.
8. Participating in group meeting/discussion.
9. Gathering primary and secondary data/information through various sources, storage, retrieval and analysis of the gathered data.
10. Assisting officials and managers in their work.
11. Undertaking a short action research work.
12. Consulting current technical journals and periodicals in the library.

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