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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*
BTAU701	DCS	COMBUSTION AND HEAT TRANSFER	3	0	2	4	60	20	20	30	20

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 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.

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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

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-Rekhman 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.*
9. *"Heat transfer" by Mills AF and Ganesan V, Pearson, 2009.*
10. *"Heat and Mass transfer" by Cengel Yunus A, TMH, 2011.*

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.

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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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							THEORY			PRACTICAL	
			L	T	P	CREDITS	END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTAU702(1)	DES	VEHICLE DIAGNOSTICS	3	0	0	3	60	20	20	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):

The objective of the course is to describe the (A) Machine Faults, (B) Measurement of fault (C) Data acquisition and signal processing techniques, (D) Fault Diagnosis.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate the following:

1. Student will be familiar with vehicle maintenance procedures.
2. Student gain the knowledge of maintenance procedures for various engine component and chassis systems.
3. Students will be able to do maintenance of electrical system.
4. Students will be able to do maintenance of lubrication system, fuel system cooling system etc.

Syllabus

Unit - I

Maintenance Schedules and Records: Importance of maintenance, preventive (scheduled) and breakdown (unscheduled) maintenance, requirements of maintenance, preparation of check lists. Inspection schedule, Maintenance of records and its formats; log sheets and other forms, safety precautions in maintenance.

Unit - II

Engine Diagnostics: Dismantling of engine components and cleaning, cleaning methods, visual and dimensional inspections, minor and major reconditioning of various components, reconditioning methods, engine assembly, special tools used for maintenance overhauling, engine tune up.

Unit – III

Chassis Diagnostics: Diagnostics of automobile clutch and gear box, servicing/maintenance of propeller shaft and differential system. Diagnostics of suspension systems problems, Brake systems problems and their rectification. Steering systems; overhauling and maintenance. Wheel alignment; computerized alignment and wheel balancing.

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Unit-IV

Electrical System Maintenance: Testing methods for checking electrical components, checking battery, starter motor, charging systems, DC generator and alternator, ignitions system, lighting systems. Fault diagnosis and maintenance of modern electronic controls, checking and servicing of dash board instruments.

Unit - IV

Diagnostics of Other Systems Problems: Servicing and maintenance of fuel system of different types of vehicles, calibration and tuning of engine for optimum fuel supply. Cooling systems problems: water pump, radiator, thermostat, anti-corrosion and antifreeze additives. Lubrication maintenance, lubricating oil changing, greasing of parts. Vehicle body maintenance, Minor and major repairs. Door locks and window glass actuating system maintenance.

Text and References Books:

1. *"Advanced Engine Performance Diagnosis" by James D.Halderman, PHI, 2011.*
2. *Bosch Automotive Handbook, Sixth Edition, 2004.*
3. *"Maintenance planning and control" by Higgin L.R. Mc Graw Hill, 1997.*
4. *"Practical Machinery Vibration Analysis and Predictive Maintenance" by C. Scheffer & Paresh Girdhar; Elsevier, 2004.*
5. *"Vehicle Maintenance and Garage Practice" by Jigar A. Doshi, D.U.Panchal and J.P.Maniar, PHI Learning Pvt. Ltd, 2014.*
6. "Advanced automotive fault diagnosis" by Tom Denton, Elsevier BH, 2006.

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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*
BTAU702(2)	DES	HYBRID AND ELECTRIC VEHICLES	3	0	0	3	60	20	20	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):

(A) Choose a suitable drive for an electric hybrid vehicle depending on resources.
(B)To Design and develop basic schemes of electric vehicles and hybrid electric vehicles.
(C)To choose proper energy storage systems for vehicle applications

Course Outcomes (COs):

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

1. Student would be able to understanding of the working principle of Hybrid & Electric Vehicles.
2. Student would be able to understand the recent trends of Hybrid & Electric Vehicles.
3. Student would be able to Analyze different power converter topology used for electric vehicle application
4. Student would be able to develop the electric propulsion unit and its control for application of electric vehicles
5. Student would be able to identify various communication protocols and technologies used in vehicle networks

Syllabus

Unit - I

Electric and Hybrid Electric Vehicles: Configuration of Electric Vehicles, Performance of Electric Vehicles, Traction motor characteristics, Tractive effort and Transmission requirement, Vehicle performance, Tractive effort in normal driving; Energy consumption Concept of Hybrid Electric Drive Trains; Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive trains.

Unit – II

Energy storage for EV and HEV: Energy storage requirements: Battery parameters, Types of Batteries; Modelling of Battery, Fuel Cell basic principle and operation; Types of Fuel Cells; PEMFC and its operation; Modelling of PEMFC; Super Capacitors.

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Unit – III

Electric Propulsion: EV consideration; DC motor drives and speed control; Induction motor drives, Permanent Magnet Motor Drives, Switch Reluctance Motor Drive for Electric Vehicles, Configuration and control of Drives.

Unit - IV Design of Electric and Hybrid Electric Vehicles: Series Hybrid Electric Drive Train Design: Operating patterns, control strategies, Sizing of major components, power rating of traction motor, power rating of engine/generator, design of PPS Parallel Hybrid Electric Drive Train Design: Control strategies of parallel hybrid drive train, design of engine power capacity, design of electric motor drive capacity, transmission design, energy storage design.

Unit-V Power Electronic Converter for Battery Charging:

Charging methods for battery, Termination methods, charging from grid, The Z-converter, Isolated bidirectional DC-DC converter, Design of Z converter for battery charging; High-frequency transformer based isolated charger topology; Transformer less topology.

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.*
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. AbulMasrur, DavidWenzhongGAO; Publisher: Wiley Publication, 2011.*

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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*
BTAU702(3)	DES	MATERIAL HANDLING AND STORAGE SYSTEMS	3	0	0	3	60	20	20	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):

The objective of the course is to describe the (A) material handling and storage system, (B) material handling equipments, automated material handling, (C) Automated storage systems and case study.

Course Outcomes (COs):

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

1. To familiarize fundamentals of material handling.
2. To familiarize common material handling systems and Automated of material handling.
3. Students will be able to understand the basics of Automated Material Handling
4. Student would be able to understand of storage system used in industrial and manufacturing sector.
5. Students would be able to demonstrate various case studies based on material handling and storage system.

Syllabus

Unit - I

Introduction- Definitions, Objectives, Cost of Handling, when to Design Handling, Material Factors, automated Material Handling Systems, scope of Material Handling, application of Material Handling Equipment, Modern trends in material handling.

Unit - II

Common Material Handling Equipment's- Concepts of Unit Loads, Material handling and Storage equipment's operation and selection, Containers, Pallets, Conveyor systems, Industrial trucks, Wagon tipplers, Transporters, Stackers, Reclaimers, Silos & hoppers and their accessories, Ropeways, Ship loaders, Cable cranes, Container handling systems, Electric lifts & Hoists, EOT cranes, Elevators, Material handling equipment's in Steel mills, Power plants, Mines, Automobile and Transport Industries, Large scale Constructions etc.

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Unit - III

Automated Material Handling- Material handling function; Types of material handling equipment; Analysis of Material handling Systems: consideration of material and movement conditions, material handling analysis techniques; Design of the System: effect of plant layout, principles of material handling; Conveyor Systems: types of conveyors, quantitative relationships and analysis of conveyor systems; Automated Guided Vehicle Systems (AGVS): types of AGVS, applications, vehicle guidance and routing, traffic control and safety, system management, quantitative analysis of AGV Systems.

Unit - IV

Storage Systems- Storage System Performance : Types of materials stored in factory, storage capacity, system throughput, storage transactions, utilization, uptime reliability; Automated Storage / Retrieval Systems (AS/RS); Definition, important categories of automated storage /retrieval system, basic components of an AS /RS, AS/RS controls, special features and applications.

Unit-V

Case Studies- Case study related to manufacturing and industrial practices.

Reference Books:

1. *"Automation, Production Systems and CIM", by Groover. M. P., Prentice hall India, 2007*
2. *"Manufacturing Automation", by Morris A. Cohen, Uday M. Apte., Irwin, Chicago, 1997.*
3. *"Robots and Manufacturing Automation", by Ray Asfahl. C., 2nd edition, John Wiley & Sons, New York, 1999.*
4. *"Facilities planning", by James A. Tompkins., John wiley & Sons Inc, 1994*
5. *"Principles of layout and material handling", by James. M. Apple, Ronald press, 1977.*
6. *"Introduction to Materials Handling" by Siddhartha Ray, New Age International Private Limited; Nineteen edition, 2017.*

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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*
BTME702(4)	DES	SQC AND TOTAL QUALITY MANAGEMENT	3	0	0	3	60	20	20	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):

To introduction with (A)Modern quality control techniques to include the design of statistical process control systems, (B) Acceptance sampling and process improvement, (C) Quality Principles, Tools and Techniques.

Course Outcomes (COs):

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

1. Student would be able to understand the need of Quality, and its concepts and need.
2. Student would be able to understand various available statistical tools of quality monitoring.
3. Student would be able to analyses basics of Quality Management and able to understand various management tools and techniques.
4. Students would be able to understand the statistical and economical design issues associated with the monitoring tools.
5. Students will be able to understand the basics of Quality Function Deployment and its tools and techniques.

Syllabus

Unit I

Introduction of Statistical quality Control &TQM

Quality: Definition, need, evolution, The Meaning of Quality and Quality Improvement; Brief History of Quality Methodology; Statistical Methods for Quality Control and Improvement; Total Quality Management: quality philosophies (Contributions of Deming, Juran and Crosby, links between quality and productivity, quality costs legal aspects of quality implementing quality improvement).

Unit II

Methods and Philosophy of Statistical Process Control

Chance and assignable causes, Statistical Basis of the Control Charts (basic principles, choices of control limits, sample size and sampling frequency, rational subgroups, analysis of pattern on control charts, warning limits, ARL, sensitizing rules for control charts); Deming's Magnificent Seven Implementing SPC; An Application of SPC; Nonmanufacturing application of SPC.

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Unit III

Control Charts for Variables

Control Charts for $\bar{X}$ and R (statistical basis, development and use, estimating process capability; interpretation, the effect of non normality on the chart, the OC function, and average run length); Control Charts for $\bar{X}$ and S; Control Chart for Individual Measurements; Applications of Variables Control Charts.

Unit IV

Inferences about Process Quality

Sampling distributions, estimation and confidence interval for process parameter(s), hypothesis testing on process parameter(s) and power analysis, Process Capability Ratios, Process Capability Analysis, Exponentially Weighted Moving Average Control Chart, Moving Average Control Chart

Unit V

TQM Tools & Techniques I & II

Seven traditional tools of quality, new management tools, Six-sigma: Concepts, methodology, application to manufacturing, service sector including IT, Bench marking: reason, process. FMEA, Just-In-Time, Kanban system MRP vs JIT system, Waste elimination, workers involvement through JIT. QFD, Taguchi quality loss function, Inspection: acceptance sampling, OC curve, producer and consumer risk, theoretical invalidation of AS, kp rule for stable and chaotic processes.

Reference Books:

1. *"Statistical Quality Control" by E.L. Grant and R.S. Leavenworth, 6th edition, McGraw-Hill publisher, 1988.*
2. *"Principles of Quality Control", by Jerry Banks, Wiley publisher, 1989.*
3. *"Total Quality Management" by D. H. Besterfiled, Pearson Education Asia, Third Edition, Indian Reprint, 2006.*
4. *"The Management and Control of Quality" by J. R. Evans and W. M. Lindsay; South-Western (Thomson Learning), Sixth Edition, 2005.*
5. *"Total Quality Management" by Naidu, Babu and Rajendran; New age International pub; First Edition Reprint, 2013*

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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*
BTAU703	DCS	VEHICLE DYNAMICS	3	1	2	5	60	20	20	30	20

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. Student will be able to understand the Performance Characteristics and Aerodynamics of vehicle.
2. Student will be able to identify the various forces and loads and performance under acceleration, ride and braking.
3. Student 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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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.*

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.

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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	DCS	AUTOMOTIVE AIR CONDITIONING	3	1	2	5	60	20	20	30	20

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.

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 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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Unit – III

Automotive Cooling and Heating System

Types of compressor: 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*
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.*

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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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2018-19

BBAI501 HUMAN VALUES AND PROFESSIONAL ETHICS

SUBJECT CODE	SUBJECT 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	Human Values and Professional Ethics	60	20	20	-	-	4	-	-	4

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

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

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, Essence, Features and Sources
2. Sources and Classification
3. Hierarchy of Values
4. Values Across Culture

Unit II: Morality

1. Definition, Moral Behaviour and Systems
2. Characteristics of Moral Standards
3. Values Vs Ethics Vs Morality
4. Impression Formation and Management

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Unit III: Leadership in Indian Ethical Perspective.

1. Leadership, Characteristics
2. Leadership in Business (Styles), Types of Leadership (Scriptural, Political, Business and Charismatic)
3. Leadership Behaviour, Leadership Transformation in terms of Shastras (Upanihads, Smritis and Manu-smriti).

Unit IV: Human Behavior – Indian Thoughts

1. Business Ethics its meaning and definition
2. Types, Objectives, Sources, Relevance in Business organisations.
3. Theories of Ethics, Codes of Ethics

Unit V: Globalization and Ethics

1. Sources of Indian Ethos & its impact on human behavior
2. Corporate Citizenship and Social Responsibility – Concept (in Business),
3. Work Ethics and factors affecting work Ethics.

Suggested Readings

1. Beteille, Andre (1991). ***Society and Politics in India***. Athlone Press:New Jersey.
2. Chakraborty, S. K. (1999). ***Values and Ethics for Organizations***. oxford university press
3. Fernando, A.C. (2009). ***Business Ethics - An Indian Perspective*** .India: Pearson Education: India
4. Fleddermann, Charles D. (2012). ***Engineering Ethics***. New Jersey: Pearson Education / Prentice Hall.
5. Boatright, John R (2012). ***Ethics and the Conduct of Business.***Pearson. Education: New Delhi.
6. Crane, Andrew and Matten, Dirk (2015). ***Business Ethics***. Oxford University Press Inc:New York.
7. Murthy, C.S.V. (2016). Business ***Ethics – Text and Cases***. Himalaya Publishing House Pvt. Ltd:Mumbai
8. Naagrajan, R.R (2016). ***Professional Ethics and Human Values***. New Age International Publications:New Delhi.

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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*
BTAU705	DS	MINOR PROJECT	0	0	4	2	0	0	0	30	20

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 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. A combined report is to be submitted. Also, a presentation* is to be made for the reviewers* on the work done by the candidate.

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

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

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)

(A)Introduction to floating point arithmetic. Introduction to numerical methods for Euler and Navier-Stokes equations with emphasis on error analysis, consistency, accuracy and stability. (B)Modified equation analysis (dispersion vs. dissipation) and Von Neumann stability analysis. (C)Finite difference methods, finite volume and spectral element methods. Explicit vs. implicit time stepping methods. Solution of systems of linear algebraic systems. (D)Higher-order vs. higher resolution methods. Computation of turbulent flows.

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. To understand mathematical characteristics of partial differential equations.
2. To understand basic properties of computational methods – accuracy, stability, consistency
3. To learn computational solution techniques for time integration of ordinary differential equations
4. To learn computational solution techniques for various types of partial differential equations
5. To learn how to computationally solve Euler and Navier-Stokes equations
6. To acquire basic programming and graphic skills to conduct the flow field calculations and data analysis.

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.

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Unit - III

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 Tranfer", 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 Modeling and simulation software.
2. Solution for the one dimensional wave equations using explicit method of lax using finite difference method (code development).
3. Solution for the one dimensional heat conduction equation using explicit method using finite difference method (code development).
4. Generation of the Algebraic Grid (code development).
5. Generation of the Elliptic Grids (code development).
6. Introduction to ANSYS Modeling and simulation software.
7. Numerical simulation of Flow over an airfoil using software.
8. Numerical simulation of Flat plate boundary layer using software.
9. Numerical simulation of Laminar flow through pipe using software.
10. Numerical simulation of Flow past cylinder using software.

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