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SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT*				
BTAU701	DCS	COMBUSTION AND HEAT TRANSFER	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 20 marks.

Course Educational Objectives (CEOs)

The Students (A) Will Be Able to familiarize with different branches of mechanics(B)with emphasis on their analysis and application to practical engineering problems (C) efficiently & effectively (D)

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 apply knowledge of S.I. and C.I. engines.
2. To identify, formulate Steady State Conduction.
3. Demonstrate variable conductivity.
4. Demonstrate Heat transfer coefficient and combustion system.
5. 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, 5th edition.*
2. *"Fundamentals of Internal Combustion Engines", by Paul W. Gill & James H. Smith, Oxford & IBH Pub. Ltd., 4th edition.*
3. *"A Course in Internal Combustion Engines", by* V. *M. Domkundwar*, *Dhanpat Rai Publication, 3rd edition.*
4. *"Internal Combustion Engines", by V. Ganesan, Tata McGraw-Hill, 2nd edition.*
5. *"Internal Combustion Engines", by M.L. Mathur & R.P. Sharma, Dhanpat Rai Publications, 4th edition.*
6. *Heat and Mass transfer"; by CengelYunus A; TMH*
7. *"Heat and Mass Transfer"; by Yadav R; Central India pub-Allahabad*
8. *"Heat and Mass Transfer"; by Baehr HD;Stephan K; MacMillan Pub*
9. *"Heat and Mass Transfer"; by Incropera FP and Dewitt DP; Wiley*
10. *"Heat transfer", by Holman JP; TMH*
11. *"Heat and Mass Transfer", by Nag PK; TMH*

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List of experiments (please expand it);

1. Conduction through a rod to determine t
2. 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

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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT*				
BTAU712	DES	FAULT DIAGNOSIS AND TROUBLESHOOTING	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 20 marks.

Course Educational Objectives (CEOs):

To introduction with (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 would be able to understand machinery faults and its generation modes.
2. Student would be gain knowledge of sensors used for measurement of machine parameters.
3. Students would be able to understand the phenomenon of data acquisition and signal processing.
4. Students will be ableto understand the use of NDT techniques to diagnose machine faults.
5. Student would be able to machinery fault diagnosis and troubleshooting.

Syllabus

Unit - I

Machinery Faults: Machinery faults, causes of machinery faults, modes of machine failures, fault generation in different components of machine; bearing faults, gear faults, fault in electrical motors, faults in rotating and non-rotating machineries, FMECA,

Unit - II

Measuring Sensors: Introduction, sensors, microprocessors and transducers, displacement, position and proximity pickups, characteristics and mounting of transducers,measurement of noise, vibration etc.

Unit – III **Data Acquisition and Signal Processing:**,Computer aided data acquisition, conversion of mechanical signal into electrical signals.

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Signal Processing: Introduction, Signal processing devices and techniques, The Fast Fourier transform (FFT) analysis, time waveform analysis, phase signal analysis, spectral signal processes, wavelet analysis, ANN and fuzzy logic etc.

Unit-IV

Non Destructive Tastings: Difference between destructive and nondestructive testing, visual inspection, crack detection techniques; magnetic crack detection & dye penetration, radiography, oil analysis, wear particle analysis, strain gauge technology, ultra-sonic crack detection, thermography etc.

Unit - IV

Fault Diagnosis& Troubleshooting: Online and off-line condition monitoring, machine signatures, temperature, vibration, wear particle and noise monitoring, signature analysis and their significance, current signature analysis, acceptable standards, rectification of problem, performance trending, potential failure (PF) curves, case studies.

References Books:

1. *"The vibration analysis handbook" by James I. Tylor;VibrationConsultants, Tampa, Florida, 1999.*
2. *"Vibration Spectrum Analysis" by Steve Goldman; Industrial PressInc., New York, 1994.*
3. *"Mechanical Vibrations" by A H Church; John Wiley & Sons Inc.,2005.*
4. *"Shock and Vibration Handbook" by Cyril M. Harris & Allan G. Piersol; McGraw-Hill Publishing Co.,*
5. *"Journal of Institute of Rail Transport"; Institute of Rail Transport (India).*
6. *"Vibratory Condition Monitoring of Machines" by J. S. Rao;Narosa Publishing House, New Delhi*
7. *"Practical Machinery Vibration Analysis and Predictive Maintenance" by C. Scheffer& Paresh Girdhar; Elsevier.*

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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT*				
BTAU722	DES	HYBRID AND ELECTRIC VEHICLES	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 20 marks.

Course Educational Objectives (CEOs):

(A)To choose a suitable drive for developing 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 ofHybrid & 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, SuperCapacitors

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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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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT*				
BTAU732	DES	MATERIAL HANDLING AND STORAGE SYSTEMS	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 20 marks.

Course Educational Objectives (CEOs):

To introduction with (A)Introduction,(B)Common material handling equipment's, 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. C2nd edition, John Wiley & Sons, New York, 1992.*
4. *"Facilities planning", by James A. Tompkins., John wiley & Sons Inc, 1984*
5. *"Principles of layout and material handling", by James. M. Apple,", Ronald press, 1977*

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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT*				
BTAU742	DES	SQC AND TOTAL QUALITY MANAGEMENT	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 20 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 managementtools 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 Deploymentand 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 philosophy(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

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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.

Unit III

Control Charts for Variables

Control Charts for $\bar{X}$ andR (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-*
2. *Hill publisher.*
3. *"Principles of Quality Control", by Jerry Banks, Wiley publisher.*
4. *"Total Quality Management" by D. H.Besterfiled; Pearson Education Asia,Third Edition, Indian Reprint, 2006.*
5. *"The Management and Control of Quality" by J. R. Evans and W. M. Lindsay; South-Western (Thomson Learning), Sixth Edition, 2005.*
6. *"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	TEACHER ASSESSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT*				
BTAU703	DCS	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 20 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,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), Understeer and Oversteer, 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*
2. *"Fundamentals of Vehicle dynamics", by Thomas D Gillespie, SAE USA 1992*
3. *"Vehicle Dynamics & control", by Rajesh Rajamani, Springer*
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*
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*

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.

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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 thevehicle 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	TEACHER ASSESSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT*				
BTME704	DCS	REFRIGERATION AND 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 20 marks.

Course Educational Objectives (CEOs):

To introduction with (A) Refrigeration, (B) Vapour Compression Refrigeration, (C) Unconventional Refrigeration Systems and Future Trends (D) Psychrometric and Air conditioning loads calculation.

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 Refrigeration system, and its importance, need and applications.
2. Students would be able to analyses basics of vapour compression refrigeration. .
3. Students would be able to understand desirable properties of refrigerants.
4. Students will be able to understand absorption refrigeration system.
5. Students would be able to calculation of psychrometric properties of air by tables and charts.
6. Students would be able to calculation of summer & winter air conditioning load.

Syllabus

Unit - I

Introduction to Refrigeration

Principles and methods of refrigeration, freezing; mixture cooling by gas reversible expansion, throttling, evaporation, Joule Thomson effect and reverse Carnot cycle; unit of refrigeration, coefficient of performance, vortex tube & thermoelectric refrigeration, adiabatic demagnetization; air refrigeration cycles- Joule's cycle Boot-strap cycle, reduced ambient cycle and regenerative cooling cycles.

Unit - II

Vapour Compression Refrigeration

Vapor compression cycle, p-h and t-s diagrams, deviations from theoretical cycle, sub-cooling

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and super heating, effects of condenser and evaporator pressure on cop; multi-pressure system: removal of flash gas, multiple expansion & compression with flash inter cooling; low temperature refrigeration: production of low temperatures, cascade system, dry ice, production of dry ice, air liquefaction system,.

Unit – III
Unconventional Refrigeration Systems and Future Trends
Vapor Absorption Systems: absorption cycle, Lithium-bromide system, heat-exchangers, analyzer and diffusers; The Electrolux system; Steam-Jet Refrigeration, Thermo-Electric Refrigeration. Low-temperature refrigeration: Cascade systems, Joule-Thompson effect, liquefaction of gases, application areas.
Refrigerants: nomenclature & classification, desirable properties, common refrigeration, comparative study, leak detection methods, environment friendly refrigerants and refrigerant mixtures, brine and its properties.

Unit – IV
Psychrometric
Calculation of psychrometric properties of air by table and charts; psychrometric processes: sensible heating and cooling, evaporative cooling, cooling and dehumidification, heating and humidification, mixing of air stream, sensible heat factor; principle of air conditioning, requirements of comfort air conditioning, ventilation standards, infiltrated air load, fresh air load human comfort, effective temperature & chart, heat production & regulation of human body,

Unit-V
Air Conditioning Loads
calculation of summer & winter air conditioning load, bypass factor of coil, calculation of supply air rate & its condition, room sensible heat factor, grand sensible heat factor, effective sensible heat factor, dehumidified air quantity. Problems on cooling load calculation. Air distribution and ventilation systems.

Note: Refrigerant tables, Refrigeration and Air-conditioning Data Book and certified data tables are allowed in the examination hall.

Reference Books:
1. *"Refrigeration and Air Conditioning", by C. P. Arora, Tata McGraw Hill.*
2. *"Refrigeration and Air Conditioning", by A. R .Trott and T. C. Welch, Butterworth-Heinemann.*
3. *"Refrigeration and Air Conditioning Technology", by Whitman, Jhonson and Tomczyk, Thomson Delmer Learning.*
4. *"Refrigeration and Air Conditioning", by Abdul Ameen, Prentice Hall of India Ltd.*

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5. *"Basic Refrigeration and Air Conditioning", by P. N. Ananthanarayan, Tata McGraw Hill.*
6. *"Refrigeration and Air Conditioning", by Wilbert F. Stoecker and Jerold W. Jones, Tata McGraw Hill.*
7. *"Refrigeration and Air Conditioning", by Richard Charles Jordan, Gayle B. Priester, Prentice hall of India Ltd.*
8. *ASHRAE Handbook – Refrigeration 2010,*

List of Experiments:

1. To find the coefficient of performance of Vapour compression Refrigeration (VCR) system
2. To find the Refrigeration effect of Vapour compression Refrigeration (VCR) system
3. To find coefficient of performance of Air-conditioner Trainer system
4. To find Refrigeration effect of Air-conditioner Trainer system
5. To find various psychometric properties of Air
6. Evaluate the various performance parameters of A Cooling Tower
7. Evaluate the various performance parameters of Evaporative cooler
8. To prove the relation between the coefficient of performance of a Heat Pump and a Refrigerator.

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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B. Tech.in Automobile Engineering

SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT*				
BTAU705	DS	MINOR PROJECT	0	0	0	50	50	0	0	6	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 20 marks.

Syllabus

Purpose

To carry out a design project in one of the specializations of the program with substantial multidisciplinary component.

Instructional Objectives

To guide the students in such a way so that they carry out a work on a topic as a forerunner to the full-fledged project work to be taken subsequently in VIII semester. The project work shall consist of substantial multidisciplinary component

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SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT*				
BTME706	DS	COMPUTATIONAL FLUID DYNAMICS LAB	0	0	0	0	30	0	0	4	2

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 20 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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SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT*				
BTME707		MECHATRONICS LAB	0	0	0	0	20	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 20 marks.

Course Educational Objectives (CEOs):

To introduction with (A)To enable the student to understand the modern mechatronics component.(B)To present the underlying principles and alternatives for mechatronics systems design.(C)To provide the student with the opportunity for hands-on experience with the related components of the technology for diverse domains of application

Course Outcomes (COs):

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

1. To understand the working of Sensors AND Transducers
2. To understand the principle and working of System models and Controllers, Logic Controllers.
3. Able to Design Mechatronics System

Syllabus

Unit - I

Mechatronics, Sensors AND Transducers: -Introduction to Mechatronics Systems – Key elements, Information systems, Real time interfacing, Elements of data acquisition system. Sensors and Transducers – Performance Terminology – Sensors for Displacement,Position and Proximity; Velocity, Motion, Force, Fluid Pressure, Liquid Flow, Liquid Level, Temperature, Range sensors, Light Sensors, Humidity, Vibration. Special transducers - Piezoelectric transducer – Magnetostrictive transducer - Shape memory alloy (SMA) transducer. – Selection of Sensors.

Unit - II

SignalConditioning:-Signal Conditioning & Interfacing Microcontroller- Comparison between microprocessor and micro controller, organization of a microcontroller system, architecture of controller and Applications. Computer Numerical Control systems (a) Position and velocity control loops (b) Adaptive Control applications for machine tools like lathe, grinding etc. Digital Logic Control – Micro Processors Control.

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Unit - III

System models and Controllers: Building blocks of Mechanical, Electrical, Fluid and Thermal Systems. Rotational – Translational Systems, Electromechanical Systems – Hydraulic – Mechanical Systems. Continuous and discrete process Controllers – Control Mode – Two Step mode – Proportional Mode – Derivative Mode – Integral Mode – PID Controllers – DigitalControllers – Velocity Control – Adaptive Control.

Unit - IV

ProgrammingLogicControllers:-PLC: Introduction to the design and mode of operation of programmable logic control (PLC) – Basic Structure– Input / Output Processing – Programming – Mnemonics – Timers, Internal relays and counters – Shift Registers – Master and Jump Controls – Data Handling – Analog Input / Output – Selection of a PLC.

Unit-V

Designof Mechatronics System: Introduction to MEMS, Micro sensors in mechatronics, Sensors for condition monitoring, Artificial intelligence in mechatronics, Stages in designing Mechatronics Systems – Traditional and Mechatronic Design Possible Design Solutions. Case studies of Mechatronics systems- Pick and place Robot- piece counting system, Autonomous mobile robot-Wireless surveillance balloon- Engine Management system- Automatic car park barrier.

Reference Books:

1. *"Basic Mechanical Engineering" by D.K.Gupta & A. Kumar; Publisher: Dhanpat Rai & Co., 2009.*
2. *"Mechatronics", by Bolton, Pearson education, second edition, fifth Indian Reprint, 2003*
3. *"Mechatronics integrated technologies for intelligent machines", Smaili.A and Mrad.F Oxford university press, 2008*
4. *"A Textbook of Mechatronics", Rajput. R.K, S. Chand & Co, 2007*
5. *"Introduction to Mechatronics and Measurement Systems", Michael B. Histand and David G. Alciatore McGraw-Hill International Editions, 2000.*
6. *"Mechatronics", Bradley D. A., Dawson D., Buru N.C. and. Loader A.J, Chapman and Hall, 1993.*
7. *"Mechatronics" Dan Necsulesu, Pearson Education Asia, 2002 (Indian Reprint).*
8. *"Mechatronics", HMT, Tata McGraw-Hill Publishing Company Ltd., New Delhi 2004.*

List of Experiments:

1. Study of Various Types of Transducers.
2. Proportional Integral Derivative (PID) controller interfacing.
3. Basic cylinder sequencing operations using Pneumatic trainer Kit.
4. Study and Simulation of basic Hydraulic, Pneumatic and Electric circuits using software.

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5. Modeling and analysis of basic electrical, hydraulic and pneumatic systems using LAB VIEW.
6. Basic operations and interfacing of Sensors in Lab view.
7. Study of PLC and Its Applications.
8. Study of frequency response of closed loop systems using MATLAB.
9. Speed Control of AC & DC drives.
10. Servo controller interfacing for DC motor.
11. Stepper motor interfacing with 8051 Micro controller.

(i)Full step resolution (ii) half step resolution.

12. Write a program to run a stepper motor in clockwise direction and in anticlockwise direction.

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