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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*
BTME701	DCS	AUTOMOBILE ENGINEERING	3	1	2	5	60	20	20	30	20

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit;
***Quiz/ 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 knowledge of (A) chassis layout, suspension system, braking system, (B) wheel and tyres, frame and body, transmission, steering system, (C) ignition system, automotive air conditioning & automotive safety is imparted in this subject.

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 automobile in society.
2. Student would be able to analyses basics of automobile and able to understand various applications.
3. Students would be able to understand wheels, Tyres, steering system & suspension system
4. Students will be able to understand the basics of gearbox, drives.
5. Student would be able to understand automobile safety and their need.
6. Students would be able to understand clutches, brakes and ignition system.
7. Students would be able to understand automotive air conditioning & automotive safety

Syllabus

Unit-1

Frame, Body, Clutches, & Brakes: Layout of chassis, types of chassis frames and bodies, their constructional features and materials. Single plate, multi-plate, cone clutch, semi centrifugal, electromagnetic, vacuum and hydraulic clutches. Fluid coupling. Classification and function; Mechanical, hydraulic, vacuum air and self-engineering brakes; Brake shoes and lining materials.

Unit-II

Gear Boxes, Drives: Sliding mesh, constant mesh, synchromesh and epicyclic gear boxes, Automatic transmission system; Hydraulic torque converter overdrive, Propeller shaft, Universal joints, Differential; Rear axle drives. Hotchkiss and torque tube drives; Rear axle types; Front wheel and all-wheel drive.

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Unit-III

Wheels, Tyres, Steering system & Suspension system: Tyre types, Tyre construction; Tyre inflation pressure, Tyre wear and their causes; Re-treading of the tyre, steering gear boxes, Steering linkages, Steering mechanism, Under and Over steering. Steering Geometry, Effect of camber, caster, king pin inclination, toe in and toe out; Power steering; Integral and linkage types. Objective and requirements, Suspension spring, front and rear suspension systems, Independent suspension system Shock absorbers.

Unit:-IV

Automotive Electrical System & Ignition System: Battery construction, Charging and testing, battery types, Starting and Battery Charging System: Starter motor construction, types of drive, Alternator construction, regulation and rectification. Magneto and coil ignition systems, System components and requirements, automotive lighting: Wiring systems Electrical instruments; head lamp, electric horn, fuel level indicator.

UNIT:-V

Automotive Air Conditioning & Automotive Safety: Introduction, Loads, Air conditioning system Components, Refrigerants, Fault Diagnosis. Automotive Safety: Safety requirements, Safety Devices, Air bags, belts, radio ranging, NVS (Night Vision System) GPS(Global Positioning System).

Text / Reference Books:

1. *"A Course in Automobile Engineering" by RP Sharma,,Dhanpat Rai & Sons, 2007.*
2. *"A Text book of Automobile Engineering" by P S Gill, Katson Books Vol. 1&2 2010.*
3. *"Automobile Engineering" by Kirpal Singh, Standard Pub., 2003.*
4. *"A Text book of Automobile Engineering" by R K Rajpoot, Laxmi Publications 2007.*
5. *"The Automotive Chassis: Engineering Principles" by Jornsen Reimpell, Helmut Stoll and Jurgen Betzler, (P) Ltd 2001.*

List of Experiments:

1. Valve refacing and valve seat grinding and checking for leakage of valves
2. Trouble shooting in cooling system of an automotive vehicle
3. Trouble shooting in the ignition system, setting of contact breaker points and spark plug gap
4. Demonstration of steering system and measurement of steering geometry angles and their impact on vehicle performance.
5. Trouble shooting in braking system with specific reference to master cylinder, brake shoes, overhauling of system and the adjusting of the system and its testing.
6. Fault diagnosis in transmission system including clutches, gear box assembly and differential.
7. Replacing of ring and studying the method of replacing piston after repair.

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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(1)	DES	POWER PLANT ENGINEERING	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) This course on Power Plant Engineering covers the various methods of converting various source of energy into electric energy (electric power) and thermodynamics analysis of their working cycle, and how to handle other component of power plant (B) This course shall be very helpful to the engineering student to develop essential skill & knowledge of the Power Plant Engineering in demand.

Course Outcomes (COs):

After learning the course the students should be able to:

1. Understand the different power generation methods, its economics and global energy situation.
2. Apply the basic thermodynamics and fluid flow principles to different power generation methods.
3. Analyze thermodynamic cycles of steam power plant and understand construction, working and significance of its various systems.
4. Analyze thermodynamic cycles of gas turbine power plant, nuclear power plant and jet propulsion systems.
5. Perform the preliminary design/analysis of the major components or systems of a conventional or alternative energy power plant.
6. Calculate the performance of gas turbines with reheat and regeneration, and discuss the benefit of combined cycle power plants.

Syllabus

Unit-I

Introduction: Introduction to methods of energy conversion (from various sources) into electric power, direct conversion methods renewable energy sources: solar, wind, tidal, geothermal, bio-thermal, biogas and hybrid energy systems, fuel cells, thermoelectric modules, MHD-Converter.

Unit-II

Steam Power Plant: Layout, site selection, coal burning methods, disposal of ash and dust, combined cycle power plants, integrated coal gasification, major plant components: condensers, cooling-towers.

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Nuclear Power Plant: Location, component of nuclear plants, types of reactors, Uranium enrichment, safety and disposal of nuclear waste, comparison with thermal plants.

Unit-III

Hydro Electric Power Plant: Elements of hydrological computations, rainfall run off, flow and power duration curves, mass curves, storage capacity, salient features of various types of hydro stations, component such as dams, spillways, intake systems, head works, pressure tunnels, penstocks, reservoir, balancing reservoirs, Micro and pico hydro machines, selection of hydraulic turbines for power stations, selection of site.

Unit-IV

Coal and Ash Handling System: Coal storage, Burning systems, Types of stokers and their working, Pulverized fuel handling systems, Unit and central systems, Pulverized mills- ball mill, Bowl mill, Ball & race mill, Impact or hammer mill, Pulverized coal burners, Oil burners, Necessity of ash disposal, mechanical; hydraulic; pneumatic and steam jet ash handling system, Dust collection and its disposal, Mechanical dust collector, Electrostatic precipitator. **Feed Water Treatment**: Necessity of feed water treatment, Different impurities found in feed water, Effect of impurities, pH & its role in corrosion and scale formation, Internal & external water treatment systems – Hot lime soda process, Zeolite ion exchange process, Demineralization plants, Reverse osmosis process, Sea water treatment using reverse osmosis, De-aeration

Unit-V

Economics of Power Generation: Load curves, Load duration curves, Connected load, Maximum load, Peak load, Base load and peak load power plants, Load factor, Plant capacity factor, Plant use factor, Demand factor, Diversity factor, Cost of power plant, Performance and operating characteristics of power plant, Tariff for electric energy.

Reference Books:

1. *"Power Plant Engineering" by M. K. Gupta, PHI Learning Pvt. Ltd., 2012.*
2. *"Power Plant Engineering" by P.K. Nag, McGraw-Hill Education, 2014.*
3. *"Thermal Engineering"by R.K. Rajput, McGraw-Hill Education, 2013.*
4. *"Power Plant Engineering" by V. M. Domkundwar, Dhanpath Rai & Co., 2007.*
5. *"Power Plant Engineering" by C.P. Sharma, Kataria and Sons., 2016.*
6. *"Steam and Gas Turbine" by R. Yadav, Central Publishing House, 2015.*

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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(2)	DES	ADVANCED PRODUCTION TECHNOLOGY	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 Objectives:-
The primary objective of the course is to describe and develop knowledge of (A) advanced production technology and Jigs & Fixtures (B) Gear manufacturing, (C) Group technology and flexible manufacturing system, (D) Computer integrated manufacturing.

Course Outcomes:-
After completion of this course the students will be able to describe the followings:

1. Students will be able to understand & describe concepts of advanced production technology.
2. Students will be able to describe advanced Jigs and fixtures used for production.
3. Students will be able to describe the principles of gear manufacturing and its nomenclature.
4. Students will be able to understand the working principles Group technology and flexible manufacturing system.
5. Students will be able to understand the concepts of computer integrated manufacturing.

Syllabus

Unit-I
Advanced Production Technology: Need for advanced production technology; Classifications of Unconventional or advanced Manufacturing Processes; Construction and working principal of unconventional machining processes such as USM, WJM, AJM, Chemical Machining, Electrolytic Grinding, EDM, LBM, EBM, Plasma Arc Cutting etc. and applications & limitations.

Unit-II
Jigs and Fixtures:
Definition, Principles of location, locating method and devices; principles of clamping, clamping devices; drilling jigs and its types; drill bushes, fixture and economics; types of fixture; milling, grinding, broaching, assembly fixtures indexing jig and fixtures, indexing devices.

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Unit-III

Gear Manufacturing

Types of gears; nomenclature of spur and helical gears; Gear generating and forming processes: concept, differences and applications, working and application of gear milling, gear hobbing and gear shaping machines; Nomenclature of gear hob and gear shaping cutter; Gear Cutting parameters for commonly used materials and work-piece; Gear finishing processes- shaving & grinding.

Unit-IV:

Flexible Manufacturing System: definition, types of FMS and applications; concept of flexibility, need of flexibility, types of flexibilities and its measurement; economic justification for FMS; Functional requirements for FMS equipments.

Unit-V

Group Technology: GT concept, advantages of GT; part family formation-coding and classification Systems; part-machine group analysis; Production flow analysis; Methods for cell formation; FMS related problem and Solution Methodology.

Reference Book:

1. *"Automation, Production System & Computer Integrated Manufacturing" by Mikell P. Grooer, Prentice Hall, 2008.*
1. *"Workshop Technology" by W. A. J. Chapman part I, II & III, 5th ed., 2001.*
2. *"Manufacturing Technology" by P. N. Rao, Vol. 1 and 2, 2018.*
3. *"Fundamentals of Machining and Machine Tools" by D.G. Boothroy and W.A. Knight, Marcel Dekker, NY, 2007.*
4. *"Elements of Workshop Technology" by Hazra Chaudhary Vol I, II, 12th ed., 2007.*
5. *"Metal Cutting Theory and Practice" by Bhattacharya, New Central Book Agency, 2000.*
6. *"Principles of Metal Cutting" by G. Kuppuswamy, Universities Press, 1996.*
7. *"Metal forming-Fundamentals and Applications" by T Altan, Soo-Ik-Oh and H.L. Gegel, American Society of Metals, Metal Park, 1983.*
8. *"Fundamentals of Metal Cutting and Machine Tools" by B.L. Juneja and G.S. Sekhon, New Age International, 2003.*

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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*
BTME702(3)	DES	RELIABILITY AND MAINTENANCE ENGINEERING	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 Objectives:-

The primary objective of the course is to describe the (A) Reliability concepts and systems reliability models, (B) Maintenance concepts and strategies, (C) Condition Based Maintenance, (D) RCM, TPM and failure mode analysis.

Course Outcomes:-

After completion of this course the students will be able to describe the followings:

1. Students will be able to describe concepts of reliability and systems reliability models.
2. Students will be able to describe maintenance concepts and strategies.
3. Students will be able to describe the condition based maintenance.
4. Students will be able to understand and describe RCM, TPM and failure mode analysis.

Syllabus

Unit-I

Basic Concepts of Reliability:

Probability distributions used in maintenance engineering: Binomial, Poisson, Exponential, Normal, Log-normal, Gamma and Weibull distribution. Failure rate, hazard rate, failure modes, MTTR, MTBF, MTTF.

Unit-II

System Reliability Models:

System reliability, n-component series systems, m-component parallel systems and combined system; standby systems; K-out-of-m systems; redundancy techniques in system design; event space, decomposition (Key Stone), cut and tie sets, Markov analysis, reliability and quality, unreliability, maintainability, availability.

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Unit-III

Maintenance Concepts and Strategies: Introduction, maintenance functions and objectives, maintenance planning and scheduling, maintenance organization.

General Introduction to Maintenance Types: Breakdown, emergency, corrective, predictive, and preventive; maintenance prevention; design-out maintenance, productive maintenance, shutdown maintenance and scheduled maintenance.

Unit-IV:

Condition Based Maintenance: Principles of CBM, pillars of condition monitoring, CBM implementation and benefits; condition monitoring techniques- visual monitoring, vibration monitoring, wear debris monitoring, corrosion monitoring, performance monitoring.

Unit-V

Reliability Centered Maintenance (RCM):- Concept, methodology, benefits.

Total Productive Maintenance: Evolution of TPM, TPM objectives, concept, pillars of TPM.

Failure Modes and Effects Analysis (**FMEA**), Effects and Criticality Analysis (**FMECA**): Overview, elements of FMECA, applications and benefits, risk evaluation, risk priority numbers, criticality analysis, process FMEA, qualitative and quantitative approach to FMECA; design FMEA and steps for carrying out design FMEA.

Text and Reference Books:

1. *"Industrial Maintenance Management" by S.K. Srivastava, S. Chand and Co., 2010.*
2. *"Maintenance Engineering and Management" by K. Venkataraman, PHI Learning, Pvt. Ltd., 2007.*
3. *"An Introduction to Reliability & Maintainability Engg" by C.E. Ebeling, Tata Mcgraw Hill, 2004.*
4. *"Installation, Servicing and Maintenance" by S.N. Bhattacharya, S. Chand and Co., 1995.*
5. *"Maintenance Engineering Hand book" by L.R. Higgins, 6th Edition, McGraw Hill, 2001.*
6. *"Handbook of Condition Monitoring" by Davies Chapman & Hall, 1998.*
7. *"Reliability and Maintenance Engineering" by R.C. Mishra, New age International publisher, 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*
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*
BTME703	DCS	INDUSTRIAL AUTOMATION AND PRODUCTION SYSTEM	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):

To introduce the students with; the Industrial Automation, technologies and 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 modelling and simulation tool for the given manufacturing application.

Syllabus

Unit-I

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

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).

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Unit – III

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

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

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

Unit – V

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.

Reference Books:

1. *"Automation, Production Systems and Computer Integrated Manufacturing" by M. P. Groover, Pearson Education, 5th edition, 2009.*
2. *"Computer Based Industrial Control" by Krishna Kant, EEE-PHI, 2nd edition, 2010.*
3. *"An Introduction to Automated Process Planning Systems" by Tiess Chiu Chang & Richard A. Wysk, Prentice Hall, 1985.*
4. *"Industrial Robotics-Groove" by Weiss, Nagel, McGraw Hill International, 2nd Ed. 2012.*
5. *"Performance Modelling of Automated Manufacturing Systems" by Viswanandham, PHI, 1st edition, 2009.*
6. *"Automation for Productivity", by Luke H.D, John Wiley & Sons, New York, 1972.*
7. *"Industrial Automation and Robotics" by A.K. Gupta and S.K. Arora, Univ. Science Press, 3rd Ed. 2013.*

List of Experiments:

1. To study the various components of automation of production system.
2. To study the material handling system and its automation principles.
3. To study the various components of industrial control systems.
4. Development of human machine interface using any SCADA package.
5. Study of distributed control systems.
6. Study of automated production lines.
7. Case studies on industrial automation and production systems.

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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*
BTME704	DCS	REFRIGERATION AND 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):

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 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

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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.

References

1. *"Refrigeration and Air Conditioning" by C. P. Arora, Tata McGraw Hill, 2006.*
2. *"Refrigeration and Air Conditioning" by A. R .Trott and T. C. Welch, Butterworth-Heinemann, 5th Ed. 2016.*
3. *"Refrigeration and Air Conditioning Technology" by Whitman, Jhonson and Tomczyk, Thomson Delmer Learning, 2005.*
4. *"Refrigeration and Air Conditioning" by Ahmadul Ameen, Prentice Hall of India Ltd, 2006.*

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5. *"Basic Refrigeration and Air Conditioning" by P. N. Ananthanarayan, Tata McGraw Hill, 4th ed. 2013.*
6. *"Refrigeration and Air Conditioning" by Wilbert F. Stoecker and Jerold W. Jones, Tata McGraw Hill, 2009.*
7. *The 2019 ASHRAE Handbook—HVAC Applications, 2019.*

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.

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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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							THEORY			PRACTICAL	
			L	T	P	CREDITS	END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTME705	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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							THEORY			PRACTICAL	
			L	T	P	CREDITS	END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTME707	DCS	MECHATRONICS 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):

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

Signal Conditioning: 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 and 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, Digital Controllers, Velocity Control, Adaptive Control.

Unit - IV

Programming Logic Controllers: 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

Design of 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" by 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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