



Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore
Shri Vaishnav Institute of Technology and Science
Choice Based Credit System (CBCS) Scheme in light of NEP-2020
B. Tech in Mechanical Engineering
(2023 - 2027)

COURSE CODE	CATEG ORY	COURSE NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTME701A	DSE	AUTOMOBILE ENGINEERING	60	20	20	0	0	3	0	0	3

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

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

Course Educational Objectives (CEOs):

This course provides knowledge of and familiarity with (A) Automotive Chassis, Transmission, and Braking Systems; (B) Automotive Electrical Systems and Safety Technologies; and (C) Electric Vehicles, Electric Drives, and Battery Management Systems (BMS).

Course Outcomes (COs):

After successful completion of the course, students will be able to:

1. Explain automotive chassis, clutch, brake, transmission, and steering systems.
2. Describe wheels, tyres, suspension, and automotive electrical systems.
3. Interpret automotive safety systems and modern vehicle technologies.
4. Explain electric vehicles, electric drives, and Battery Management Systems (BMS).
5. Analyze conventional and electric vehicle systems.

Syllabus

Unit-I

(9 Hrs)

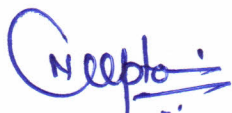
Frame, Body, Clutches, and Brakes: Chassis layout; types of chassis frames and bodies; constructional features and materials. Types of clutches: single-plate, multi-plate, cone, semi-centrifugal, electromagnetic, vacuum, and hydraulic clutches; fluid coupling. Brakes: classification, functions, and types; mechanical, hydraulic, vacuum, air, and self-energizing brakes; brake shoes and lining materials.

Unit-II

(9 Hrs)

Gear Boxes and Drives: Types of gear boxes: sliding mesh, constant mesh, synchromesh, and epicyclic; automatic transmission system; hydraulic torque converter and overdrive. Drives; propeller shaft, universal joints, differential, rear axle types and drives, front-wheel drive, and all-wheel drive.

Steering system: steering gear boxes, steering linkages, steering mechanisms, understeering and oversteering, steering geometry, effects of camber, caster, kingpin inclination, toe-in, and toe-out; power steering.



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Unit-III

(9 Hrs)

Wheels, Tyres, and Suspension: Wheel types, tyre types and construction, tyre inflation pressure, tyre wear and its causes, tyre retreading. **Suspension:** suspension springs, front and rear suspension systems, independent suspension system, and shock absorbers.

Automotive Electrical Systems: Battery construction, types, charging, and testing; starting and charging systems: starter motor construction, starter drives, alternator construction, regulation, and rectification; automotive lighting, wiring systems, and electrical instruments.

Unit-IV:

(9 Hrs)

Automotive Safety and Modern Vehicle Technologies: Safety requirements; active and passive safety systems; safety devices: seat belts, airbags, Anti-lock Braking System (ABS), and Electronic Stability Control (ESC); vehicle sensors: camera, radar, LiDAR, and ultrasonic sensors; Advanced Driver Assistance Systems (ADAS); parking assist system; Global Positioning System (GPS) and navigation system; Internet of Things (IoT) and Artificial Intelligence (AI) in automobiles.

Unit-V

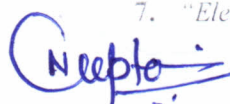
(9 Hrs)

Electric Vehicles and Electric Drives: Types of electric vehicles: Battery Electric Vehicle (BEV), Hybrid Electric Vehicle (HEV), Plug-in Hybrid Electric Vehicle (PHEV), and Fuel Cell Electric Vehicle (FCEV); electric drives: types of traction motors, motor selection and sizing, speed–torque characteristics, motor controllers, and regenerative braking.

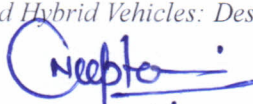
Battery Management System (BMS): functions of BMS, battery thermal management, battery charging methods, fast charging, and wireless charging.

Textbooks:

1. "A Course in Automobile Engineering" by R. P. Sharma, Dhanpat Rai Publications, 2022.
2. "A Textbook of Automobile Engineering" by P. S. Gill, Katson Books, 2022.
3. "Automobile Engineering" by Kirpal Singh, Standard Publishers Distributors, Vol. I & II, 2014.
4. "A Textbook of Automobile Engineering" by R. K. Rajput, Laxmi Publications, 2018.
5. "Automotive Technology: A Systems Approach" by Jack Erjavec and Rob Thompson, Cengage Learning, 2021.
6. "Automotive Electrical and Electronic Systems" by Tom Denton, Routledge, 2022.
7. "Electric and Hybrid Vehicles: Design Fundamentals" by Iqbal Husain, CRC Press, 2021.



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Reference Books:

1. "The Automotive Chassis: Engineering Principles" by Jörnßen Reimpell, Helmut Stoll, and Jürgen Betzler, Butterworth-Heinemann, Latest Edition.
2. "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design" by Mehrdad Ehsani, Yimin Gao, Sebastian E. Gay, and Ali Emadi, CRC Press, 3rd Edition, 2018.
3. "Electric Vehicle Technology Explained" by James Larminie and John Lowry, Wiley, 2nd Edition, 2012.
4. "Understanding Automotive Electronics" by William B. Ribbens, Butterworth-Heinemann, 2017.
5. "Bosch Automotive Handbook" by Robert Bosch GmbH, Wiley, 2018.
6. "Vehicle Dynamics: Theory and Application" by Reza N. Jazar, Springer, 2023.
7. "Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles" by Sheldon S. Williamson, Springer, 2013.

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BTME701B	DSE	GAS DYNAMICS AND JET PROPULSION	60	20	20	0	0	3	0	0	3

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Course Educational Objectives (CEOs):

This course provides the concept and knowledge of (A) Turbo Machinery, (B) Steam Turbines, Water Turbines, (C) Rotary Fans, Blowers and Compressors.

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 basic concepts and isentropic flow.
2. Students would be able to understand the compressible flow through ducts.
3. Students would be able to understand normal and oblique shocks.
4. Students will be able to understand the jet and space propulsion.

Syllabus

Unit-I

(9 Hrs)

Basic Concepts and Isentropic Flows

Energy and momentum equations of compressible fluid flows, Concepts of compressible flow – Mach waves and Mach cone. Flow regimes, effect of Mach number on compressibility. Stagnation, static, critical properties and their interrelationship. Isentropic flow and its relations. Isentropic flow through variable area ducts – nozzles and diffusers. Use of Gas tables.

Unit-II

(9 Hrs)

Compressible Flow through Ducts

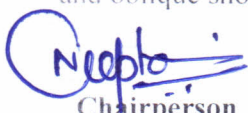
Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties. Choking. Isothermal flow with friction.

Unit-III

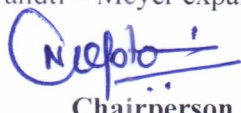
(9 Hrs)

Normal and Oblique Shocks

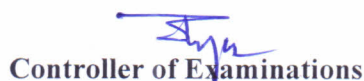
Governing equations - Rankine-Hugoniot Relation. Variation of flow parameters across the normal and oblique shocks. Prandtl – Meyer expansion and relation.


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BTME701B	DSE	GAS DYNAMICS AND JET PROPULSION	60	20	20	0	0	3	0	0	3

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Unit-IV

(9 Hrs)

Jet Propulsion

Introduction, Real-world applications, design considerations, operational challenges, and recent advancements in jet propulsion systems. Theory of jet propulsion – thrust equation – Performance parameters - thrust, power and efficiency. Operation, cycle analysis and performance of ram jet, turbojet, turbofan, turbo prop and pulse jet engines.

Unit-V

(9 Hrs)

Space Propulsion

Types of rocket engines and propellants. Characteristic velocity – thrust equation. Theory of single and multistage rocket propulsion. Liquid fuel feeding systems. Solid propellant geometries. Orbital and escape velocity. Rocket performance calculations

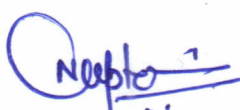
Text / Reference Books:

1. "Modern Compressible flow" by J.D. Anderson, McGraw Hill, latest edition.
2. "Fundamentals of Compressible Flow" by S.M. Yahya, New Age International (P) Limited, New Delhi, 2018.
3. "Gas Turbine Theory" by H. Cohen, G.E.C. Rogers and Saravanamutto, Pearson, 2019.
4. "Gas Turbines" by V. Ganesan, Tata McGraw Hill Publishing Co., New Delhi, 2017.
5. "Rocket Propulsion Elements" by G.P. Sutton, John Wiley, New York, 2026.
6. "Theory of Aerospace Propulsion" by Pasquale M. Sforza Butterworth-Heinemann, 2017.
7. "Mechanics and Thermodynamics of Propulsion" by Philip G. Hill and Carl R. Peterson, Pearson Education, 2nd Edition.



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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTME701C	DSE	INDUSTRIAL AUTOMATION AND PRODUCTION SYSTEM	60	20	20	0	0	3	0	0	3

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

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

Course Outcomes (COs):

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

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

Syllabus

Unit-I

(8 Hrs)

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

Unit – II

(9 Hrs)

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

Unit – III

(9 Hrs)

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

Unit – IV

(9 Hrs)

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

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

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

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

Unit – V **(10 Hrs)**

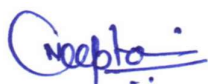
Assembly Lines: Fundamentals of Manual Assembly Lines, Alternative Assembly Systems, Design for Assembly, Analysis of Single Model Assembly Lines. Line balancing problem, largest candidate rule, Ki Bridge and Wester method, and Ranked Positional Weights Method, Mixed Model Assembly Lines, Considerations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

Textbooks:

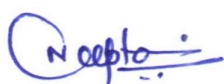
1. "Automation, Production Systems and Computer Integrated Manufacturing" by M. P. Groover, Pearson Education, 2024.
2. "Industrial Automation and Robotics" by A. K. Gupta and S. K. Arora, Mercury Learning & Information, Latest Edition
3. "Industrial Automation and Process Control" by Jon Stenerson,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

Reference Books:

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



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BTME703N	DCC	TURBOMACHINERY	60	20	20	30	20	3	0	2	4

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Course Educational Objectives (CEOs)

This course will provide the knowledge of (A) Basic concepts of turbo-machinery, (B) Steam Turbines, Water Turbines and Pumps (C) Rotary Fans, Blowers and Compressors.

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 need and concepts of turbo machineries.
2. Students would be able to understand the concepts of impulse and reaction turbines; and pumps.
3. Students would be able to understand working of Rotary Fans, Blowers and Compressors.
4. Students will be able to understand working of steam turbine.
5. Students would be able to understand the concepts of power transmission.

Syllabus

Unit – I

(8 Hrs)

Introduction to Turbo Machinery: Fluid Properties, Moment of momentum equation and Euler turbine equation, principles of impulse and reaction machines, energy equation for relative velocities, one-dimensional analysis only.

Unit – II

(10 Hrs)

Water Turbines & Centrifugal Pumps: Classification, Pelton, Francis & Kaplan turbines, velocity triangles, work done, draft tubes, governing methods. Centrifugal Pumps: Classification, advantages over reciprocating pumps, heads (manometric, gross & static), velocity triangles, work done. Performance & Characteristics (Water Turbines & Centrifugal Pumps): Dimensional analysis, similarity laws, unit & specific quantities, machine selection, hydraulic, volumetric, mechanical & overall efficiencies, operating characteristics, and cavitation.

Unit – III

(10 Hrs)

Rotary Fans, Blowers and Compressors: Classification based on pressure rise, centrifugal & axial flow machines. Centrifugal Blowers: Vane shape, velocity triangles, slip coefficient, machine size & speed, vane stresses, efficiencies, fan laws & characteristics. Centrifugal & Axial Flow Compressors: Velocity triangles, work done, temperature & pressure ratio, slip factor, work input factor, pressure coefficient, inlet eye, impeller & diffuser design.

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Unit - IV

(10 Hrs)

Steam Turbines: Introduction, Industrial Applications, Selection criteria, Impulse & reaction turbines, velocity & pressure compounding (Curtis & Rateau stages), utilization factor, blade & stage efficiencies, optimum efficiency, mass flow & blade height. industrial applications, turbine selection, control systems & performance characteristics. Modern Turbine Control Strategies; Digital control systems, condition monitoring, and predictive maintenance.

Unit-V

(8 Hrs)

Power Transmitting Turbo Machines: Applications, general theory; torque ratio, speed ratio, slip, efficiency, velocity diagrams, fluid coupling & torque converter, characteristics. Hydraulic Systems: Positive displacement & turbo machines, comparison, hydrostatic systems, hydraulic intensifier, accumulator, press & crane.

Text and Reference Books:

1. "Turbomachines" by A. Venkanna and B. K. Venkanna, PHI Learning Pvt. Ltd., 2018.
2. "Principles of Turbomachinery" by D. G. Shepherd, Macmillan Education, Latest Edition.
3. "An introduction to Energy Conversion Vol. III" by Kadambi V Manohar Prasad; Wiley Eastern Delhi, 2011.
4. "Fluid Mechanics & Fluid Machines" by Bansal R. K; Laxmi Publication, 2019.
5. "Steam Turbine: Theory & Practice" by Kearton W. J.; CBS Pub. Latest Edition.
6. "Turbomachinery Performance Analysis" by R. I. Lewis, Butterworth-Heinemann, Latest Edition.

List of Experiments

1. To study the characteristics of a centrifugal pump.
2. Performance test on a centrifugal pump.
3. To study different type of compressors.
4. To Study of centrifugal blower and axial fan.
5. To Study of Pelton, Francis and Kaplan turbines.
6. Performance test on a Pelton/Francis turbine.
7. To Study of fluid coupling and Torque converter.
8. Determination of pump and turbine efficiencies.
9. Velocity triangle analysis for turbines and compressors.

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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTME703N	DCC	TURBOMACHINERY	60	20	20	30	20	3	0	2	4

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

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

Unit - IV

(10 Hrs)

Steam Turbines: Introduction, Industrial Applications, Selection criteria, Impulse & reaction turbines, velocity & pressure compounding (Curtis & Rateau stages), utilization factor, blade & stage efficiencies, optimum efficiency, mass flow & blade height. industrial applications, turbine selection, control systems & performance characteristics. Modern Turbine Control Strategies; Digital control systems, condition monitoring, and predictive maintenance.

Unit-V

(8 Hrs)

Power Transmitting Turbo Machines: Applications, general theory; torque ratio, speed ratio, slip, efficiency, velocity diagrams, fluid coupling & torque converter, characteristics. Hydraulic Systems: Positive displacement & turbo machines, comparison, hydrostatic systems, hydraulic intensifier, accumulator, press & crane.

Text and Reference Books:

1. "Turbomachines" by A. Venkanna and B. K. Venkanna, PHI Learning Pvt. Ltd., 2018.
2. "Principles of Turbomachinery" by D. G. Shepherd, Macmillan Education, Latest Edition.
3. "An introduction to Energy Conversion Vol. III" by Kadambi V Manohar Prasad; Wiley Eastern Delhi, 2011.
4. "Fluid Mechanics & Fluid Machines" by Bansal R. K; Laxmi Publication, 2019.
5. "Steam Turbine: Theory & Practice" by Kearton W. J.; CBS Pub. Latest Edition.
6. "Turbomachinery Performance Analysis" by R. I. Lewis, Butterworth-Heinemann, Latest Edition.

List of Experiments

1. To study the characteristics of a centrifugal pump.
2. Performance test on a centrifugal pump.
3. To study different type of compressors.
4. To Study of centrifugal blower and axial fan.
5. To Study of Pelton, Francis and Kaplan turbines.
6. Performance test on a Pelton/Francis turbine.
7. To Study of fluid coupling and Torque converter.
8. Determination of pump and turbine efficiencies.
9. Velocity triangle analysis for turbines and compressors.

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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	DCC	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 10 marks.

Course Educational Objectives (CEOs):

To introduction with (A) Refrigeration, (B) Vapour Compression Refrigeration, (C) Unconventional Refrigeration Systems and Future Trends (D) Psychometric 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 concepts of refrigeration, its importance, need and applications.
2. Students would be able to understand the vapour compression refrigeration system.
3. Students would be able to understand desirable properties of refrigerants and new technologies.
4. Students would be able to calculate psychometric properties of air by tables and charts.
5. Students would be able to calculation of summer & winter air conditioning load.

Syllabus

Unit – I

(8 Hrs)

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

(9 Hrs)

Vapour Compression Refrigeration

Vapour 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 temperature refrigeration: production of low temperatures, cascade system, dry ice, production of dry ice, air liquefaction system,



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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTME704	DCC	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 10 marks.

Unit – III

(9 Hrs)

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

(10 Hrs)

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

(10 Hrs)

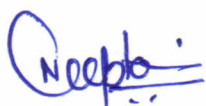
Air Conditioning Loads

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.

Text and Reference Books:

1. "Refrigeration and Air Conditioning" by C. P. Arora, Tata McGraw Hill, 2021.
2. "Refrigeration and Air Conditioning" by A. R. Trott and T. C. Welch, Butterworth- Heinemann, 5th Ed. 2016.



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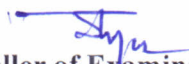
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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTME704	DCC	REFRIGERATION AND AIR CONDITIONING	60	20	20	30	20	3	0	2	4

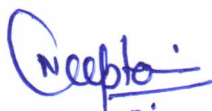
Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

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

3. "Refrigeration and Air Conditioning Technology" by Whitman, Jhonson and Tomczyk, Thomson Delmer Learning, 2020.
4. "Basic Refrigeration and Air Conditioning" by P. N. Ananthanarayan, Tata McGraw Hill, 4th ed. 2013.
5. "Refrigeration and Air Conditioning" by Wilbert F. Stoecker and Jerold W. Jones, Tata McGraw Hill, 2019.
6. The 2019 ASHRAE Handbook—HVAC Applications, 2019.

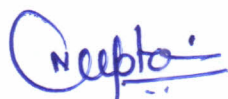
List of Experiments:

1. Study of Vapour Compression Refrigeration (VCR) Test Rig and determination of Coefficient of Performance (COP).
2. Performance analysis of a Vapour Compression Refrigeration System under different operating conditions.
3. Study and performance evaluation of a Vapour Absorption Refrigeration (VAR) System.
4. Study of Air Refrigeration System and its working principle.
5. Measurement of psychrometric properties of air using a psychrometer and plotting on the psychrometric chart.
6. Verification of psychrometric processes such as sensible heating, cooling, humidification, dehumidification, and evaporative cooling.
7. Study and performance analysis of air conditioner, including determination of COP.
8. Cooling load estimation for an air-conditioned room using psychrometric analysis.
9. Study of refrigeration system components: compressor, condenser, expansion device, evaporator, and accessories.
10. Study of refrigeration controls and safety devices, including thermostat, pressure switches, overload protector, and solenoid valve.
11. Visit/Simulation Experiment: Study of a cold storage plant or central air-conditioning system, and preparation of a technical report.



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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTME708	DCC	INDUSTRIAL ENGINEERING	60	20	20	0	0	3	0	0	3

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

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

Course Educational Objectives (CEOs):

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

Course Outcomes (COs):

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

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

Syllabus

Unit-I

(8 Hrs)

Introduction to Industrial Engineering

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

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

Unit-II

(10 Hrs)

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

Unit-III

(8 Hrs)

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



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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTME708	DCC	INDUSTRIAL ENGINEERING	60	20	20	0	0	3	0	0	3

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

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

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

Unit-IV (8 Hrs)

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

Unit-V (9 Hrs)

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

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

Text and References Books:

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



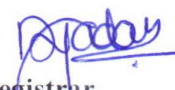
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BBA - III SEMESTER (2025-2029)

BBAI501 HUMAN VALUES AND PROFESSIONAL ETHICS

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

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

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

Course Objective

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

Examination Scheme

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

Course Outcomes

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

COURSE CONTENT

UNIT I: Human Value

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

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BBA - III SEMESTER (2025-2029)

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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BBAI501	AECC	Human Values and Professional Ethics	60	20	20	-	-	4	-	-	4

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

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

UNIT II: Morality

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

UNIT III: Leadership in Indian Ethical Perspective.

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

UNIT IV: Business Ethics

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

UNIT V: Globalization and Ethics

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

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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BBAI501	AECC	Human Values and Professional Ethics	60	20	20	-	-	4	-	-	4

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

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

Suggested Readings:

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

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

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. Individual /combined report may be submitted. Also, a presentation* will be taken to review/evaluate* the project work done by the candidate.

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

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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTME709	PW/I	INDUSTRIAL TRAINING	0	0	0	0	50	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 10 marks.

Course Educational Objective of Industrial Training:

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

Course Outcomes (COs):

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

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

Scheme of Studies:

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

Examination Scheme: -

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

(a) Work in Industry

Attendance and General Discipline: -

Daily diary Maintenance: -

Initiative and participative attitude during training: -

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

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B. Tech in Mechanical Engineering
(2023 - 2027)

COURSE CODE	CATEG ORY	COURSE NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTME709	PW/I	INDUSTRIAL TRAINING	0	0	0	0	50	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 10 marks.

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

1. Training Report
2. Seminar and Viva-Voce

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

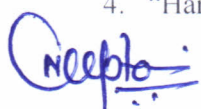
Learning through industrial training:

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

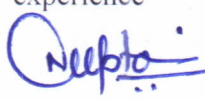
1. Organizational structure and interpersonal communication.
2. Machines/equipment/instrument-their working and specifications.
3. Manufacturing, process, product development procedure and phases etc.
4. Project Planning, monitoring and control.
5. Quality control and assurance.
6. Maintenance system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

Students are supposed to acquire the knowledge above by:

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


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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.

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

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