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/B.Tech+MBA in Mechanical Engineering

(2021-2025)

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*				
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 the knowledge and familiar with (A) Automotive Body, Chassis, Clutch and Brakes (B) Gear Boxes and Drives, (C) various automotive systems and safety.

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 automotive body, chassis, clutch and brakes.
2. Student would be able to understand the gear boxes and transmission system.
3. Students would be able to understand wheels, tyres, steering system & suspension system.
4. Students will be able to understand the electrical system & ignition system.
5. Students would be able to understand automotive air conditioning & automotive safety

Syllabus

Unit-I **(9 Hrs)**

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 of brakes, Mechanical, hydraulic, vacuum air and self-engineering brakes; Brake shoes and lining materials.

Unit-II **(9 Hrs)**

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.

Unit-III **(9 Hrs)**

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

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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;
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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: **(9 Hrs)**

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 **(9 Hrs)**

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 R.P. 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

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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTME701B	DSE	GAS DYNAMICS AND JET PROPULSION	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 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. Student would be able to understand the basic concepts and isentropic flow.
2. Student 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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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTME701B	DSE	GAS DYNAMICS AND JET PROPULSION	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.

Unit-IV **(9 Hrs)**

Jet Propulsion

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, 2012.
2. "Fundamentals of Compressible Flow" by S.M. Yahya, New Age International (P) Limited, New Delhi, 2002.
3. "Gas Turbine Theory" by H. Cohen, G.E.C. Rogers and Saravanamutto, Pearson, 2017.
4. "Gas Turbines" by V. Ganesan, Tata McGraw Hill Publishing Co., New Delhi, 2010.
5. "Rocket Propulsion Elements" by G.P. Sutton, John Wiley, New York, 2010.
6. "Theory of Aerospace Propulsion" by Pasquale M. Sforza Butterworth-Heinemann, 2011.

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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*				
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 the 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).

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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;
***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 **(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.
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.

Text and 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.

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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.

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, degree of reaction, energy equation for relative velocities, one dimensional analysis only.

Unit – II **(10 Hrs)**

Water Turbines and Pumps: Classification, Pelton, Francis and Kaplan turbines, vector diagrams and work-done, draft tubes, governing of water turbines. Centrifugal Pumps: classification, advantage over reciprocating type, definition of mano-metric head, gross head, static head, vector diagram and work done. Performance and characteristics: Application of dimensional analysis and similarity to water turbines and centrifugal pumps, unit and specific quantities, selection of machines, Hydraulic, volumetric, mechanical and overall efficiencies, Main and operating characteristics of the machines, cavitation.

Unit – III **(10 Hrs)**

Rotary Fans, Blowers and Compressors: Classification based on pressure rise, centrifugal and axial flow machines. Centrifugal Blowers Vane shape, velocity triangle, degree of reactions, slip coefficient, size and speed of machine, vane shape and stresses, efficiency, characteristics, fan laws

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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.

and characteristics. Centrifugal Compressor-Vector diagrams, work done, temp and pressure ratio, slip factor, work input factor, pressure coefficient, Dimensions of inlet eye, impeller and diffuser. Axial flow Compressors- Vector diagrams, work done factor, temp and pressure ratio, degree of reaction, Dimensional Analysis, Characteristics, surging, Polytrophic and isentropic efficiencies.

Unit - IV **(10 Hrs)**

Steam Turbines: Impulse staging, velocity and pressure compounding, utilization factor, analysis for optimum U.F Curtis stage, and Rateau stage, include qualitative analysis, effect of blade and nozzle losses on vane efficiency, stage efficiency, analysis for optimum efficiency, mass flow and blade height. Reactions staging: Parson's stages, degree of reaction, nozzle efficiency, velocity coefficient, stator efficiency, carry over efficiency, stage efficiency, vane efficiency, conditions for optimum efficiency, speed ratio, axial thrust, reheat factor in turbines, problem of radial equilibrium, free and forced vortex types of flow, flow with constant reaction, governing and performance characteristics of steam turbines.

Unit-V **(8 Hrs)**

Power Transmitting Turbo Machines: Application and general theory, their torque ratio, speed ratio, slip and efficiency, velocity diagrams, fluid coupling and Torque converter, characteristics, Positive displacement machines and turbo machines, their distinction, Hydrostatic systems hydraulic intensifier, accumulator, press and crane.

Text and Reference Books:

1. "Turbo machinery" by Venkanna BK; Publisher: PHI, 2012.
2. "Turbo machinery" by Shepherd DG; 2005.
3. "An introduction to Energy Conversion Vol. III" by Kadambi V Manohar Prasad; Wiley Eastern Delhi, 2005.
4. "Fluid Mechanics & Fluid Machines" by Bansal R. K; Laxmi Publication, 2013.
5. "Steam Turbine: Theory & Practice" by Kearton W. J.; CBS Pub. 2004.

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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.

List of Experiments

1. To study the characteristics of a centrifugal pump.
2. Verification of Impulse momentum principle.
3. To Study different types of pump.
4. To study different types of compressors.
5. To study of Pelton Turbine.
6. To study of Francis Turbine.
7. To study of Kaplan turbines.
8. To study Parson's Reaction Turbine.
9. To Study of fluid coupling and Torque converter.
10. To Study Hydrostatic systems hydraulic intensifier, accumulator, press and crane.

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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.

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.
3. Students would be able to understand desirable properties of refrigerants and new technologies.
4. Students would be able to calculation of 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

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 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, 2015.
2. "Refrigeration and Air Conditioning" by A. R .Trott and T. C. Welch, Butterworth-Heinemann, 5th Ed. 2016.

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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, 2005.
4. "Refrigeration and Air Conditioning" by Ahmadul Ameen, Prentice Hall of India Ltd, 2006.
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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BTME705	PW/I	MINOR PROJECT	0	0	0	60	40	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 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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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. Student would be able to understand concepts of production planning and inventory control in an industry.
2. Student would be able to understand the productivity management.
3. Students would be able to understand plant Layout & Material handling equipments.
4. Students will be able to understand and gain the knowledge of six sigma & lean manufacturing.

Syllabus

Unit-I **(8 Hrs)**

Introduction to Industrial Engineering

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

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

Unit-II **(10 Hrs)**

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

Unit-III **(8 Hrs)**

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

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

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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)**

Six Sigma & Lean Manufacturing

Lean: Introduction, Lean - Evolution & Steps, Introduction to Lean Manufacturing, Lean - Specify Value - Quality at Source, 5S Concepts, 5S Implementation, Identify Value Stream - Process Mapping, Why is Inventory bad, Process Layouts, Lean - Make It Flow - Setup Time Reduction, Hejunka, Total Productive Maintenance.

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 2001.
2. Mukhopadhyay S.K, "Production Planning and Control: Text and Casesby" , PHI, 2009.
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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BTME709	PW/I	INDUSTRIAL TRAINING	0	0	0	0	50	0	0	6	3

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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 the knowledge of industrial process, drawing, quality, tools maintenance, industrial technologies etc. related documentation and work.
3. Understand and gain the 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.*

Scheme of Examination:-

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

(a) Work in Industry

Attendance and General Discipline:-
Daily diary Maintenance:-
Initiative and participative attitude during training:-
Remark/Assessment of training by Industrial Supervisor (if any/required)

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BTME709	PW/I	INDUSTRIAL TRAINING	0	0	0	0	50	0	0	6	3

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

1. Training Report:-
2. Seminar and Viva-Voce:-

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

Learning through industrial training:-

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

1. Organizational structure and inter personal 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 on above by-

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

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BTME709	PW/I	INDUSTRIAL TRAINING	0	0	0	0	50	0	0	6	3

Legends: L - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
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5. Undertaking/assisting project work, manufacturing process, R&D, quality control etc.
6. Solving problems at the work place.
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 official and managers in their working
11. Undertaking a short action research work.
12. Consulting current technical journals and periodicals in the library.

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