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	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*				
BTME601A	DSE	OPERATION RESEARCH AND SUPPLY CHAIN	60	20	20	0	0	3	1	0	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 provides a fundamental understanding of (A) linear programming, assignment models and transportation model (B) Network model, waiting line models and game theory (C) Supply chain management.

Course Outcomes (COs):

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

1. Students will be able to solve linear-programming problems.
2. Students will be able to solve assignment and transportation problems.
3. Students will be able to do network analysis, waiting line problems and game theory.
4. Students will be able to understand & describe supply chain, inventory management and supply chain integration.

Syllabus

Unit-I **(10 Hrs)**

Introduction: History and development of Operations Research; Scientific Methods, Characteristics, Scope, Models in Operations Research.

Linear Programming: Formulation, graphical methods, simplex method, Big- M- method. **Linear programming models:**

Assignment Models: Definition, Mathematical Representation, Formulation and Solution, Alternate optimal solution.

Transportation Models: Definition, Formulation and solution, Alternate optimal solution, Stepping stone method, Modified distribution (MODI) or u-v method.

Sequencing Models: Processing n jobs through two machines, m machines and processing two jobs through m machines, minimal path problem

Unit-II **(9 Hrs)**

Network Analysis: Network diagram, Time estimation, Basic steps in PERT and CPM, PERT computation, CPM computation, critical path, Float, Cost analysis, crashing the network.

Unit-III **(9 Hrs)**

Waiting Line and Dynamic programming Models:

Waiting Line Model: Introduction, classification, state in queue, probability distribution of arrival and service times, Single server model (M/M/I), Multiple server model (MMS), Birth and death

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process.

Dynamic Programming: Introduction, Distribution characteristic, dynamic programming approach, optimal subdivision problem.

Unit-IV **(10 Hrs)**

Game Theory: Game Theory and Simulation Theory of Game, Competitive game, two persons, zero sum games, maxima and minima Principles, Saddle point, Method of Dominance, graphical and algebraic method of solution by transforming into linear programming problem, Monte-Carlo simulation and application.

Unit-V **(10 Hrs)**

Supply Chain and its Importance: Introduction and advantages of SC, Key National and International issues.

SC Integration: Push, pull and push-pull systems, SC strategies, direct shipment, cross-docking transshipment, centralized versus decentralized control, central versus local facilities.

SC Inventory Management and Risk Pooling: Single warehouse inventory, the economic lot size model, the effect of demand uncertainty, supply contracts, multiple order opportunities, continuous review policy, variable lead times, periodic review policy, risk pooling, centralized versus decentralized systems, forecasting techniques. Bullwhip effect, information and SC trade-offs.

Planning Demand and Supply in a SC: Demand forecasting in SC, Aggregate planning in a SC. Logistics and SC Network Configuration

Text and Reference Books:

1. "Introduction to Operations Research" by Hillier F.S., and Lieberman G.J., Tata McGraw Hill, 2005.
2. "Operations Research: An Introduction" by Taha H.A., Pearson, 2006.
3. "Operations Research" by Taha, Tata McGraw Hill, 2002.
4. "Textbook of Logistics and Supply Chain Management" by D. K. Agrawal, Macmilan, 2003.
5. "Fundamentals of Supply Chain Management: Twelve Drivers of Competitive Advantage" by John T. Mentzer, SAGE Publications, 2004.
6. "Operations Research" by Perm Kumar Gupta, Dr. D.S Hira, S.Chand publication, 2010.
7. "Operations Research" by Wagner, PHI. New Delhi, 2003.
8. "Operations Research" by Hira and Gupta, S. Chand., 2008.

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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTME601B	DSE	PRODUCTION PLANING AND CONTROL	60	20	20	0	0	3	1	0	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 Objectives:-

The primary objective of the course is to impart knowledge of (A) production planning and control (B) inventory planning and management, (C) manufacturing scheduling.

Course Outcomes:-

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

1. Production Planning and Control issues.
2. Inventory management
3. Production planing and scheduling
4. Demand forecasting and theory of constraints.

Syllabus

Unit-I **(9 Hrs)**

Introduction to Production Systems: Production Systems: Classification & Characterization, Overview of Production Planning and Control issues, Review of EOQ & inventory control systems.
Material Requirement Planning: Dependent Demand & Material Requirement Planning, Structure of MRP system, MRP Calculations, Planning Issues, Implementation Issues. .

Unit-II **(10 Hrs)**

Just in Time Production Systems: Just-in-Time System: Evolution, Characteristics of JIT Systems, Continuous Improvement, Kanban System, Strategic Implications of JIT System.
Factory Physics: Basic factory dynamics, Variability basics, Push and pull production systems, Inventory management – Functions of inventories – relevant inventory costs – ABC analysis – VED analysis – EOQ model – Inventory control systems.

Unit-III **(10 Hrs)**

Aggregate Planning: Aggregate Planning: Purpose & Methods, Reactive and Aggressive Alternatives, Planning Strategies, LP Formulation, Master Production Scheduling.

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BTME601B	DSE	PRODUCTION PLANING AND CONTROL	60	20	20	0	0	3	1	0	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
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Unit-IV: **(9 Hrs)**

Scheduling: Scheduling in Manufacturing, Sequencing Operations for One Machine, Sequencing Operations for a two-station Flow Shop, Job Shop Dispatching.

Unit-V **(10 Hrs)**

Forecasting Methods: Demand Forecasting: Principles and Methods, Judgment methods, Causal methods, Time-series methods.

Theory of Constraints: Concept of bottleneck, Local and global optima, Five steps of TOC approach, Performance measures.

Text Books:

1. "Elements of Production Planning and Control" by Samuel Eilon, Universal Publishing Corporation, 1991.
2. "Modern Production/ operation managements" by Baffa & Rakesh Sarin, willey and sons, 1997.
3. "Industrial Engineering and Production Management" by Martand Telsang, S. Chand and Company, 2000

Reference Book:

1. "Operations Management: Strategy and Analysis" by Krajewski L.J. and Ritzmen L.P., Pearson Education, 2010.
2. "Operations Management for Competitive Advantage" by Chase R.B. Jacobs F.R. and Aquilano N.J., Tata McGraw Hill Book Company, New Delhi, 2010.
3. "Factory Physics: Foundations of Manufacturing Management" by Hopp W. J. and Spearman M. L., McGraw Hill International Edition, 2008.
4. "Production Planning and Control" by Mukhopadhyay S.K., PHI, Eastern Economy Edition, 2013.
5. "Production and Operations management" by Kanishka Bedi, Oxford university press, 2007

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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*				
BTME601C	DSE	PROCESSING OF MATERIALS	60	20	20	0	0	3	1	0	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 and familiar with (A) Forming, (B) Extrusions (C) Forging and rolling (D) sheet metal working and drawing processes.

Course Outcomes (COs):
After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes of;

1. Forming process.
2. Forging process and operations.
3. Rolling process and operations.
4. Extrusion process.
5. Sheet metal forming processes and various drawing processes.

Syllabus

Unit – I **(9 Hrs)**

Introduction to forming- types, advantages and disadvantages. Typical stress-strain diagram for ductile materials. Forming properties of metals and alloys (yield strength/flow stress, ductility, strain hardening, strain rate sensitivity, effect of temperature and hydrostatic pressure on yield strength), Strain rate effects, work of plastic deformation. Flow stress curves, Super plasticity in materials, hot working and cold working operation, Relative merits and applications.

Unit – II **(10 Hrs)**

Forging: Open die and closed die forging, machine forging, upset forging etc., forging loads, forging die design. Estimation of forging loads for rectangular and cylindrical slugs. Forgeability Tests. Defects in forging, forging equipment – constructional features and operation.

Unit – III **(9 Hrs)**

Rolling: Principles of rolling, Process parameters, Estimation of rolling loads by consideration of stresses. Principles of roll pass design for various product shapes. Principles of ring rolling. Processing maps and their applications in metal working operation. Rolling mills – Their constructional features and operation.

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BTME601C	DSE	PROCESSING OF MATERIALS	60	20	20	0	0	3	1	0	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 **(9 Hrs)**

Extrusion: Classification of extrusion processes, extrusion equipment. Hot extrusion deformation and defects in extrusion. Analysis of the extrusion processes, cold extrusion. Extrusion of tubing and production of seamless pipe and tubing.

Unit-V **(10 Hrs)**

Sheet Metal Working: Standard die sets, simple, compound, combination, progressive and transfer dies. Process parameters and estimation of loads in shearing, bending, deep drawing, shear spinning operations. Mechanical and hydraulic presses, relative merits and application – constructional features and operation.

Drawing of Rods, Wires and Tubes: Rod and wire drawing, tube drawing process, residual stresses in rod, wire and tubes.

Text and Reference Books:

1. "An Introduction to the Principles of Metal Working" by Geoffery W. Rowe, TMH, 2001
2. "Sheet Metal Forming Processes and Die Design" by Vulota Boljanovic, Industrial Press, 2014.
3. "Manufacturing Sciences", by Amitabh Ghosh and Mallik, East-. West Press Pvt Ltd, 2010.
4. "Manufacturing Technology" by P. N. Rao, Vol.1, McGraw Hill Education, 2017
5. "Production Engineering" by P.C. Sharma, S.Chand Pub., 1999.
6. "Fundamentals of Metal Forming Processes" by B.L. Juneja, New Age International Publishers, 2010
7. "Material Science And Metallurgy" by U.C. Jindal and Atish Mozumder , Pearson Education India, 2012.
8. "Technology of Metal Forming Processes" by Surender Kumar, PHI, 2008

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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTME602A	DSE	ADVANCED PRODUCTION TECHNOLOGY	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 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,

Course Outcomes: -

After completion of this course:

1. Students will be able to describe concepts of unconventional production methods.
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 flexible manufacturing system.
5. Students will be able to understand the concepts and importance of group technology.

Syllabus

Unit-I **(10 Hrs)**

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 **(10 Hrs)**

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.

Unit-III **(9 Hrs)**

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

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BTME602A	DSE	ADVANCED PRODUCTION TECHNOLOGY	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.

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: **(8 Hrs)**

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 **(8 Hrs)**

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.

Text and Reference Book:

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

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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTME602B	DSE	POWER PLANT 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) Energy conversion processes and (B) various types of Power Plants and its related engineering.

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 and analyze thermodynamic cycles of steam power plant and understand construction, working and significance of its various systems.
3. Analyze thermodynamic cycles of gas turbine power plant, nuclear power plant and jet propulsion systems.
4. Perform the preliminary design/analysis of the major components or systems of a conventional or alternative energy power plant.
5. Calculate the performance of gas turbines with reheat and regeneration, and discuss the benefit of combined cycle power plants.

Syllabus

Unit-I **(8 Hrs)**

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 **(10 Hrs)**

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.

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 **(9 Hrs)**

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

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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTME602B	DSE	POWER PLANT 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.

turbines for power stations, selection of site.

Unit-IV **(10 Hrs)**

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 **(8 Hrs)**

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.

Text and 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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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTME602C	DSE	PLANT MAINTENANCE AND SAFETY	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 Objectives:-

The primary objective of the course is to impart the knowledge of (A) maintenance concepts and strategies, (B) wear, corrosion and fault diagnosis, (C) preventive maintenance, reconditioning, repairing and installation (D) industrial safety.

Course Outcomes:-

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

1. Students will be able to describe concepts and types of maintenance.
2. Students will be able to describe and understand failure due to wear/corrosion and fault diagnosis.
3. Students will be able to describe and understand PM concept and its importance.
4. Students will be able to understand repair, reconditioning, retrofitting and installation.
5. Students will be able to understand the concepts and need of industrial safety.

Syllabus

Unit-I **(9 Hrs)**

Fundamentals of maintenance engineering: Importance of maintenance, objectives of maintenance, functions of maintenance department, maintenance planning and scheduling, maintenance organization, types of maintenance, maintenance systems: planned and unplanned maintenance, breakdown maintenance, corrective maintenance, opportunistic maintenance, routine maintenance, preventive maintenance, and predictive maintenance, condition based maintenance systems, design-out maintenance, selection of maintenance systems.

Unit-II **(10 Hrs)**

Wear and Corrosion: wear; types, causes, effects, wear reduction methods, Lubricants; types and applications, lubrication methods, Corrosion; definition, principle and factors affecting the corrosion, types of corrosion, corrosion prevention methods.

Fault Diagnosis: concept and importance, decision tree-concept, need and applications, Sequence of fault finding activities, types of faults in machine tools and their general causes and remedies,

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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTME602C	DSE	PLANT MAINTENANCE AND SAFETY	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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Failure Modes and Effects Analysis (FMEA), Effects and Criticality Analysis (FMECA), documenting maintenance operations and record keeping, data collection and analysis, Failure statistics.

Unit-III **(9 Hrs)**

Periodic and Preventive Maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, Overhaul of electrical and mechanical systems; common troubles and remedies, Preventive Maintenance: definition, need, steps and advantages, planning and scheduling plant shutdowns, Steps/procedure for periodic and preventive maintenance, repair cycle-concept and importance.

Condition Monitoring: Concept of condition monitoring, advanced tools and techniques of condition monitoring for power plants equipments, condition based maintenance.

Unit-IV: **(9 Hrs)**

Reconditioning, Retrofitting and Installation: Reconditioning; process, features and advantages, Retrofitting; concept, need and applications, Installation; design and planning of foundation, erection and commissioning of equipment, alignment and testing of equipment, types and applications of tools used for maintenance, maintenance cost & its relation with replacement economy calculation of equipment service life, replacement policies, spares and types of spares, spares planning.

Unit-V **(8 Hrs)**

Industrial Safety: Various types of accidents and hazards, fire prevention, mechanical hazards, chemical hazards, noise & vibration control and their prevention and control, safety regulations, safety education and training, cautions and alarming, case studies.

Text and Reference Books:

1. "Plant Equipment & Maintenance Engineering Handbook" by Duncan C. Richardson, TMH, 2014
2. "Industrial Maintenance Management" by S.K. Srivastava, S. Chand and Co., 2010.

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BTME602C	DSE	PLANT MAINTENANCE AND SAFETY	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.

3. "Maintenance Engineering and Management" by K. Venkataraman, PHI Learning, Pvt. Ltd., 2007.
4. "An Introduction to Reliability & Maintainability Engg" by C.E. Ebeling, Tata Mcgraw Hill, 2004.
5. "Installation, Servicing and Maintenance" by S.N. Bhattacharya, S. Chand and Co., 1995.
6. "Maintenance Engineering Hand book" by L.R. Higgins, 6th Edition, McGraw Hill, 2001.
7. "Handbook of Condition Monitoring" by Davies Chapman & Hall, 1998.
8. "Reliability and Maintenance Engineering" by R.C. Mishra, New age International publisher, 2006.

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BTME603	DCC	MECHANICAL VIBRATION	60	20	20	30	20	3	1	2	5

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs)

This course provides a fundamental understanding of (A) Vibration and noise in mechanical system and machines (B) Design modifications to reduce the vibration and noise(C) increase the life of components and control noise.

Course Outcomes (COs)

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

1. Understand free and forced vibrations of single degree freedom systems.
2. Analyze balancing problems in rotating and reciprocating machinery.
3. Understanding causes, source and types of vibrations in machineries.
4. Gaining knowledge in sources and measurement standard of noise.
5. Ability to design and develop vibrations and noise control systems.

Syllabus

Unit – I (10 Hrs)

Fundamental Aspects of Vibrations: Definition of Vibration, main causes, advantages and disadvantages; engineering applications of vibration and noise; vector method of representing harmonic motion; characteristics of vibration, harmonic analysis and beats phenomenon, work done by harmonic forces on harmonic motion; periodic, non-harmonic functions- Fourier series analysis; evaluation of coefficients of Fourier series; elements of vibratory system; lumped and distributed parameter systems.

Un-damped Free Vibrations: Derivation of differential equation of motion: the energy method, the method based on Newton's second law of motion, and Rayleigh's method. Solution of differential equation of motion: Natural frequency of vibration. Systems involving angular oscillations: compound pendulum.

Unit – II (9 Hrs)

Damped Free Vibrations: Viscous damping: coefficient of damping; damping ratio; under damped, over damped and critically damped systems; logarithmic decrement; frequency of damped free vibration; Coulomb or dry friction damping; frequency, decay rate and comparison of viscous and Coulomb damping; solid and structural damping; slip or interfacial damping.

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BTME603	DCC	MECHANICAL VIBRATION	60	20	20	30	20	3	1	2	**5**

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Unit – III **(9 Hrs)**

Harmonically excited Vibration: One degree of freedom, forced harmonic vibration vector representation of forces; excitation due to rotating and reciprocating unbalance; vibration Isolation, force and motion transmissibility; absolute and relative motion of mass (Seismic Instruments).
Whirling Motion and Critical Speed: Whirling motion and Critical speed: Definitions and significance. Critical speed of a vertical, light flexible shaft with single rotor: with and without damping .Critical speed of a shaft carrying multiple discs (without damping), Secondary critical speed.

Unit – IV **(9 Hrs)**

Systems With Two Degrees of Freedom: Un-damped free vibration of 2 d.o.f and Principal modes of vibration; torsion vibrations; Forced, Un-damped vibrations with harmonic excitation; Coordinate coupling; Dynamic vibration absorber; torsion Vibration Absorber; Pendulum type of dynamic vibration.

Unit-V **(8 Hrs)**

Noise Measurement & Control: Noise and its causes, sound pressure / intensity / power level and their inter-relation, Decibel scale, Loudness and equal loudness contours, Effect of machine / process noise on operators, employees and local residents. Standards of noise level and exposure limit, Methods of industrial noise control, Measurement of noise, Sound spectra and octave band analysis. Background noise, weighted networks.

Text Books:

1. "Theory of Vibrations with Applications" by W.T. Thomason, M.D. Dahleh and C. Padmanabhan, Pearson, 2008.
2. "Text book of Mechanical Vibrations", by Dukikipati RV Srinivas J; Publisher PHI, 2012.
3. "Mechanical Vibrations" by S.S. Rao, Pearson, 2018.

Reference Books:

1. "Mechanical Vibrations and Noise Engineering", by Ambekar A.G; Publisher: PHI, 2013.
2. "Element of Vibration Analysis", by Meirovitch Leonard Publisher: TMH, 2010

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BTME603	DCC	MECHANICAL VIBRATION	60	20	20	30	20	3	1	2	5

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

3. "Mechanical Vibrations", by Kelly SG and kudari SK; Publisher: Schaum Series; TMH, 2011.
4. "Mechanical Vibrations" by G.K. Grover, Nem Chand & Bros, 2009.
5. "Vibrations and waves in continuous mechanical systems" by P. Hagedorn and A. Das Gupta, John Wiley, 2007.

List of Experiments

1. To find out effect of load on natural frequency of vibrations of a lever pin supported at one end carrying adjustable load on a vertical screwed bar and spring supported at some intermediate point (i) When the dead weight of rods is neglected and (ii) when their dead weight is taken into account
2. To find out frequency of damped free vibration and rate of decay of vibration-amplitude in the system
3. To find out natural frequency and damped free frequency of a torsion pendulum and, hence to find out coefficient of damping of the oil
4. To observe the phenomenon of 'whirl' in a horizontal light shaft and to determine the critical speed of the shaft
5. To observe the mode shapes of a spring-connected, double pendulum and hence to demonstrate the phenomenon of beats.
6. To demonstrate the principle of tuned Un-damped Dynamic Vibration Absorber and to determine the effect of mass-ratio (of main and auxiliary mass) on the spread of the resulting natural frequencies
7. To take measurements of sound Pressure Level (SPL) and to carry out octave band analysis of a machine using Noise Level Meter

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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTME604	DCC	HEAT AND MASS TRANSFER	60	20	20	30	20	3	1	2	5

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):
To introduction and familiar with (A) concepts of heat transfer, (B) various modes of heat transfer in detail, (C) Convection heat transfer.(D) Extended Surface, heat exchanger and concepts of thermal radiation and boiling and condensation.

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 various modes of heat transfer.
2. Students would be able to analyses basics difference of conduction, convection and radiation.
3. Students would be able to understand significant of various dimension less no in convection.
4. Students will be able to understand concept of radiation.
5. Students would be able to explain concept of mass transfer and concentration difference.

Syllabus

Unit-I **(9 Hrs)**

Basic Concepts: Modes of heat transfer, Fourier's law, Newton's law, Stefan Boltzmann law; thermal resistance and conductance, analogy between flow of heat and electricity, combined heat transfer process.

Conduction: Fourier heat conduction equation, its form in rectangular, cylindrical and spherical coordinates, thermal diffusivity, linear one dimensional steady state conduction through a slab, tubes, spherical shells and composite structures, electrical analogies, critical-insulation-thickness for pipes, effect of variable thermal conductivity.

Unit –II **(9 Hrs)**

Extended surfaces (fins): Heat transfer from a straight and annular fin (plate) for a uniform cross section; error in measurement of temperature in a thermometer well, fin efficiency, fin effectiveness, applications; Unsteady heat conduction: Transient and periodic conduction, heating and cooling of bodies with known temperatures distribution, systems with infinite thermal conductivity, response of thermocouples.

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BTME604	DCC	HEAT AND MASS TRANSFER	60	20	20	30	20	3	1	2	**5**

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Unit-III **(9 Hrs)**

Convection: Introduction, free and forced convection; principle of dimensional analysis, Buckingham 'pie' theorem, application of dimensional analysis of free and forced convection, empirical correlations for laminar and turbulent flow over flat plate and tubular geometry; calculation of convective heat transfer coefficient using data book.

Unit-IV **(8 Hrs)**

Heat exchangers: Types- parallel flow, counter flow; evaporator and condensers, overall heat transfers coefficient, fouling factors, log-mean temperature difference (LMTD), method of heat exchanger analysis, effectiveness of heat exchanger, NTU method; Mass transfer: Fick's law, equi-molar diffusion, diffusion coefficient, analogy with heat transfer, diffusion of vapour in a stationary medium.

Unit-V **(10 Hrs)**

Thermal radiation: Nature of radiation, emissive power, absorption, transmission, reflection and emission of radiation, Planck's distribution law, radiation from real surfaces; radiation heat exchange between black and gray surfaces, shape factor, analogical electrical network, radiation shields.

Boiling and condensation: Film wise and drop wise condensation; Nusselt theory for film wise condensation on a vertical plate and its modification for horizontal tubes; boiling heat transfer phenomenon, regimes of boiling, boiling correlations.

Text and References Books:

1. "Heat transfer" by Holman JP, TMH, 2011
2. "Heat and Mass Transfer" by Nag PK, TMH, 2007.
3. "Heat Transfer Principles and App, by Dutta BK, PHI Learning, 2015.
4. "Heat transfer" by Mills AF and Ganesan V, Pearson, 2009.
5. "Heat and Mass transfer" by Cengel Yunus A, TMH, 2011.
6. "Heat and Mass Transfer" by Yadav R, Central India pub-Allahabad,1992
7. "Heat and mass transfer" by Sukhatme SP, University Press Hyderabad, 2005.

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BTME604	DCC	HEAT AND MASS TRANSFER	60	20	20	30	20	3	1	2	**5**

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

List of Experiments

1. Conduction through a rod to determine thermal conductivity of material.
2. Forced and free convection over circular cylinder.
3. Free convection from extended surfaces.
4. Parallel flow and counter flow heat exchanger effectiveness and heat transfer rate
5. Calibration of thermocouple.
6. Experimental determination of Stefan Boltzmann constant.
7. Force convection from extended surfaces.
8. Study of various heat exchangers.

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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTME605N	DCC	DESIGN OF MACHINE COMPONENTS AND TOOLS	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 develops fundamental knowledge of (A) theories of failure (B) design power screw and threaded joints (C) analysis and design of gear systems, (D) design of metal working tools, jigs, fixtures and inspection gauges

Course Outcomes (COs)

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

1. Understand the failure of mechanical components
2. Design of Power Screw and Threaded Joints
3. Design gears of various types
4. Design various tools, jigs, fixtures and inspection gauges.

Syllabus

Unit – I **(8 Hrs)**

Introduction: Philosophy, Design Procedure, design considerations (strength, manufacturing, maintenance, environment, economics and safety), Engineering Materials- Classification and properties, Material selection in Machine Design, IS coding of steels and Cast Irons, Simple & Compound stresses in machine elements, Theories of failures, factor of Safety.

Unit – II **(10 Hrs)**

Design of Power Screw and Threaded Joints: Forms of thread, Single and Multiple threaded screw, Terminology of power screw, Torque requirement of lifting/lowering, Self-locking, Efficiency of threads, coefficient of friction, design of screw and nut. Basic types of screw fastening, Cap and Set screw, Bolt of Uniform strength, locking devices, Terminology of Screw thread, Bolted Joint: Simple and Eccentric loading, Torque requirement for bolt tightening, Design of turnbuckle, Elastic analysis of bolted joints.

Unit – III **(9 Hrs)**

Gear Design: Definition of gears, Classification of gears, Law of gearing, gear terminology, Lewis and Buckingham equations; wear and dynamic load consideration, Design & force analysis of spur, helical, bevel & worm gears.

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BTME605N	DCC	DESIGN OF MACHINE COMPONENTS AND TOOLS	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 **(9 Hrs)**

Design of Metal working Tools and Dies: Design of press working tools, shearing, piercing, blanking, dies, compound die, design principles for forging dies, bending, forming drawing dies, tooling for forging design principles for forging dies, drop forging, upset forging, design principles and practice for rolling, roll press design.

Unit-V **(9 Hrs)**

Design of Jigs and Fixtures: Principles of location, locating method and devices, principles of clamping, clamping devices, drilling jigs, types, drill bushes, fixture and economics, types of fixture, milling, grinding, broaching, assembly fixtures indexing jig and fixtures, indexing devices.
Design of Gauges and Inspection Features: Design of gauges for tolerance for dimensions and form inspection; dies and mould design for plastics & rubber parts: compression molding, transfer molding, blow molding

Text and Reference Books:

1. "Shigley's Mechanical Engineering Design" by R G Budynas, and K J Nisbett; Publisher: McGraw-Hill, 2011.
2. "Machine Design: An Integrated Approach" by R L Norton; Publisher: Pearson, 2006.
3. "Design of Jigs, Fixtures and Press Tools" by K. Venkataraman, John Wiley & Sons, 2015.
4. "Machine Tool Design and Numerical Control" by N.K. Mehta; TMH, 2012
5. "Tool Design" by Donaldson, T.M.H, 2010.
6. "Design of Machine Elements" by V B Bhandari; Publisher: McGraw Hill, 2010.
7. "Vehicular Engine Design", by K Hoga, B Dondlinger; Publisher: Springer, 2010.
8. "Machine Elements in Mechanical Design" by Robert L. Mott; Publisher: Macmillan Publishing Co., London, 1992
9. "Machine Design: Fundamentals and Applications", by P C Gope; Publisher: PHI, 2012.
10. "Handbook of Gear design", by Maitra, G.M; Publisher: Tata McGraw Hill, 2005.
11. "Fundamentals of Metal Cutting and Machine Tools"by Juneja, Sekhon and Seth; New Age International, 2017.

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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.

List of Experiments

1. Design of Power Screw.
2. Design of Threaded Joints.
3. Design of Spur Gear and Helical Gears.
4. Design of Bevel Gear &Worm gear.
5. Design of various press working tools.
6. Design of forging dies.
7. Design of various types of jigs.
8. Design of various types of fixtures.
9. Design of inspections tools and gauges.

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Choice Based Credit System (CBCS) Scheme in light of NEP-2020

B. Tech in Mechanical Engineering

(2023-2027)

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*				
BTME606	AESE	SIMULATION OF MECHANICAL SYSTEM LAB	0	0	0	30	20	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)

This course develop the knowledge of (A)concepts of modeling (B) computer aided modelling and various modeling tools to represent mechanical systems(C) Understand various techniques of simulation (D)Apply modeling and simulation techniques to simulate industrial systems/mechanical systems using different software packages.

Course Outcomes (COs)

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

1. Understand modeling and simulation using various softwares / programming languages.
2. Familiar with modeling software's such as Creo.
3. Ability to simulate the physical behavior of systems using Ansys, Matlab & Simulink.
4. Ability to analyze results obtained from these simulation tools.
5. They are able to do modeling and simulation of mechanical systems.

Syllabus

Unit – I **(10 Hrs)**

Modeling Basics: Models, modeling purpose, objectives and examples of models
Principles of Physical Modeling: Concept of System and environment, basic relationship; Continuous and discrete systems; Linear and non-linear systems; stochastic activities, Bond Graphs.

Unit – II **(10 Hrs)**

Computer Aided Modeling: Solid modeling of component using Creo, finite element modeling using ANSYS; Static and Dynamic models, Estimating Transient Response, Spectra and Frequency Functions; Parameter Estimation in Dynamic Models; System Identification as a Tool for Model Building.

Unit – III **(10 Hrs)**

Basic Simulation Modeling: Role of simulation in model evaluation and studies, advantages of simulation.

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System Simulation: Techniques of simulation, Monte Carlo method, Experimental nature of simulation, Numerical computation techniques.

Unit – IV **(10 Hrs)**

System Simulation and Its Types: Continuous system model; Analog and Hybrid simulation; Feedback system; Computers in simulation studies, Simulation software packages.
System Dynamics: Growth and Decay models, Logistic curves, System dynamics diagrams.

Unit-V **(12 Hrs)**

Simulation of Mechanical Systems: Building of Simulation models, simulation of translational and rotational mechanical systems, Simulation of electro mechanical, thermo - mechanical, hydraulic & pneumatic elements; Case studies related to industrial problems.

Text and Reference Books:

1. "Modeling and Simulation with HDL", by George Pelz, John Wiley & Sons Ltd, 2003.
2. "Modeling Analysis and Control of Dynamic Systems", by W.J. Palm, John Wiley, 1999.
3. "System Simulation" by Gordon, G; Prentice Hall, 2008.
4. "Modeling of Dynamic Systems" by Lennart, L. and Torkel, G., Prentice Hall, 2016.
5. "Mathematical Modeling for Design of Machine Components", by Bhonsle, S.R., and Weinmann, K.J., Prentice Hall, 1999.
6. "Bond Graph in Modeling, Simulation and Fault Identification", by Mukherjee, A., Karmaker, R. and Samantaray, A.K., I & K Internationa, 2009.
7. "Systems Modeling & Analysis", by I.J. Nagarath & M. Gopal, Tata McGraw Hill, 2005.

List of Experiments

1. Introduction to CAD (Creo) and FEM analysis software package(Ansys)
2. Solid modeling of structural components using Creo.
3. Introduction to 2D and 3D Meshing.
4. Finite element analysis of structural component using Ansys.
5. Static structural analysis of machine component using Ansys.

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6. Mode analysis of machine component using Ansys.
7. Nonlinear structural analysis using Ansys.
8. Static thermal analysis using Ansys.
9. Transient thermal analysis using Ansys.
10. Transient analysis of vibrating system Ansys.
11. Introduction to durability analysis of Mechanical component using Ansys.
12. Introduction to rigid body dynamic analysis using Ansys.
13. Introduction to Topology optimization and Structure/Weight Optimization.
14. MATLAB tutorial for simulation of various mechanical systems.

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