



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
(2024 - 2028)

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*				
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 following:

1. Students will be able to formulate and solve linear programming problems.
2. Students will be able to solve assignment and transportation problems for optimal resource allocation.
3. Students will be able to perform sequencing and network analysis using PERT and CPM techniques.
4. Students will be able to analyze waiting line models and game theory problems for decision-making.
5. Students will be able to understand and apply the concepts of supply chain management, inventory management, and logistics.

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.

Unit-II

(9 Hrs)

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

Transportation Models: Definition, Formulation and solution, Alternate optimal solution, Steppingstone method, Modified distribution (MODI) or U-V method.

Unit-III

(9 Hrs)

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

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



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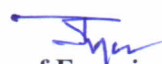
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Unit-IV

(9 Hrs)

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 process.

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, Monte-Carlo simulation and application.

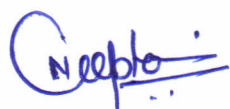
Unit-V

(10 Hrs)

Supply Chain Management: Introduction to Supply Chain (SC), its importance and advantages; key national and international issues; Push, Pull, and Push–Pull systems; Supply Chain strategies; direct shipment, cross-docking, centralized and decentralized systems; inventory management, Economic Order Quantity (EOQ), demand uncertainty, continuous and periodic review policies, risk pooling, bullwhip effect; demand forecasting, aggregate planning, logistics, and Supply Chain network configuration.

Text and Reference Books:

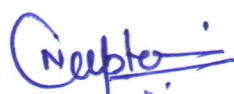
1. "Introduction to Operations Research" by Frederick S. Hillier and Gerald J. Lieberman, 12th Edition (2024 Release), McGraw-Hill Education, 2025.
2. "Operations Research: An Introduction" by Hamdy A. Taha, 10th Edition, Pearson Education, 2017.
3. "Operations Research" by Prem Kumar Gupta and D. S. Hira, 7th Edition, S. Chand Publishing, Latest Available Edition.
4. "Principles of Operations Research: With Applications to Managerial Decisions" by Harvey M. Wagner, 2nd Edition, Prentice-Hall of India (PHI Learning).
5. "Textbook of Logistics and Supply Chain Management" by D. K. Agrawal, Macmillan, 2003.
6. "Fundamentals of Supply Chain Management: Twelve Drivers of Competitive Advantage" by John T. Mentzer, SAGE Publications, 2004.
7. "Fundamentals of Queueing Theory" by Donald Gross, John F. Shortle, James M. Thompson and Carl M. Harris, 5th Edition, Wiley, 2018.
8. "Supply Chain Management: Strategy, Planning, and Operation" by Sunil Chopra and Peter Meindl, 8th Edition, Pearson Education, 2022.



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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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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 following:

1. Students will be able to understand production systems and material requirement planning.
2. Students will be able to apply JIT and inventory management techniques.
3. Students will be able to perform aggregate planning and master production scheduling.
4. Students will be able to apply scheduling and sequencing techniques.
5. Students will be able to use forecasting methods and the Theory of Constraints (TOC).

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

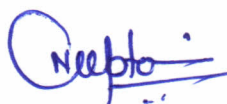
(10 Hrs)

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

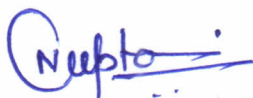
(10 Hrs)

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



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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, Latest Available Reprint.
2. "Modern Production/Operations Management" by Elwood S. Buffa and Rakesh K. Sarin, 8th Edition, John Wiley & Sons, Latest Available Reprint.
3. "Industrial Engineering and Production Management" by Martand T. Telsang, S. Chand Publishing, Latest Available Reprint.
4. "Production and Operations Management" by S. N. Chary, 7th Edition, McGraw-Hill Education, 2024.
5. "Manufacturing Planning and Control for Supply Chain Management" by F. Robert Jacobs, William L. Berry, D. Clay Whybark and Thomas E. Vollmann, 7th Edition, McGraw-Hill Education, 2022.

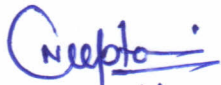
Reference Book:

1. "Operations Management: Processes and Supply Chains" by Lee J. Krajewski, Manoj K. Malhotra and Larry P. Ritzman, 13th Edition, Pearson, 2022.
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" by Wallace J. Hopp and Mark L. Spearman, 3rd Edition, Waveland Press, 2011..
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, 3rd Edition, Latest Available Reprint.



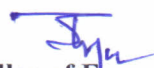
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BTME601C	DSE	PROCESSING OF MATERIALS	60	20	20	0	0	3	1	0	4

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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.

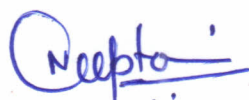
Unit – III

(9 Hrs)

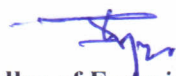
Rolling: Principles of rolling, Process parameters, Estimation of rolling loads by consideration of stresses. Principles of roll pass design for various product shapes. Principles of ring rolling. Processing maps and their applications in metal working operation. Rolling mills – Their constructional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



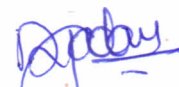
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BTME601C	DSE	PROCESSING OF MATERIALS	60	20	20	0	0	3	1	0	4

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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

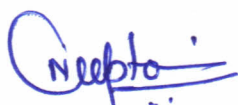
(10 Hrs)

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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BTME602A	DSE	ADVANCED PRODUCTION TECHNOLOGY	60	20	20	0	0	3	0	0	3

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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 of 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:

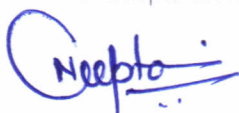
Definition, Principles of location, locating method and devices; principles of clamping, clamping devices; drilling jigs and its types; drill bushes, fixture and economics; types of fixture; milling, grinding, broaching, assembly fixtures indexing jig and fixtures, indexing devices.

Unit-III

(9 Hrs)

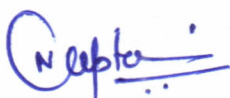
Gear Manufacturing

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

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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 equipment's.

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. "Advanced Manufacturing Processes" by V. K. Jain, Allied Publishers, 2nd Edition, 2016.
2. "Production Engineering" by P. C. Sharma, S. Chand Publishing, Latest Revised Edition (Reprint 2022).
3. "Production Technology: Manufacturing Processes, Technology and Automation" by R. K. Jain, Khanna Publishers, Latest Revised Edition (Reprint 2023).
4. "Modern Machining Processes" by P. C. Pandey and H. S. Shan, Tata McGraw-Hill Education, 1st Edition (Reprint 2020).
5. "Automation, Production Systems and Computer-Integrated Manufacturing" by Mikell P. Groover, 5th Edition, Pearson, 2024.
6. "Manufacturing Technology" by P. N. Rao, Vol. I & II, 5th Edition, McGraw Hill, 2024.
7. "Workshop Technology" by W. A. J. Chapman, Part I, II & III, 5th Edition.
8. "Elements of Workshop Technology" by S. K. Hajra Choudhury et al., 15th Edition, 2023.
9. "Fundamentals of Metal Cutting and Machine Tools" by B.L. Juneja and G.S. Sekhon, New Age International, 2003.
10. "Fundamentals of Modern Manufacturing: Materials, Processes and Systems" by Mikell P. Groover, John Wiley & Sons, 7th Edition, 2020.
11. "Jigs and Fixture Design Manual" by Erik K. Henriksen, Industrial Press, 2nd Edition



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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)

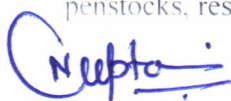
Steam Power Plant: Layout, site selection, coal burning methods, disposal of ash and dust, combined cycle power plants, integrated coal gasification, major plant components: condensers, cooling-towers.

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)

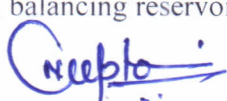
Hydro Electric Power Plant: Elements of hydrological computations, rainfall run off, flow and power duration curves, mass curves, storage capacity, salient features of various types of hydro stations, component such as dams, spillways, intake systems, head works, pressure tunnels, penstocks, reservoir,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



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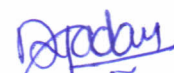
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Choice Based Credit System (CBCS) Scheme in light of NEP-2020
B. Tech Mechanical Engineering
(2024 - 2028)

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**				
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., Latest Revised Edition.
2. "Power Plant Engineering" by P. K. Nag, McGraw Hill Education, 4th Edition, 2017.
3. "Power Plant Engineering" by V. M. Domkundwar and Arora, Dhanpat Rai Publications, 9th Edition, 2022.
4. "Power Plant Engineering" by C. P. Sharma, Kataria & Sons, Latest Revised Edition.
5. "Steam and Gas Turbines" by R. Yadav, Central Publishing House, Latest Revised Edition.
6. "Thermal Engineering" by R. K. Rajput, A Trueman Publication, 11th Edition, 2013
7. "Non-Conventional Energy Resources" by G. D. Rai, Khanna Publishers, 6th Edition, 2017.



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(2024 -2028)

COURSE CODE	CATE GORY	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*				
BTCSME501	DSE	ARTIFICAIL INTELLIGENCE AND MACHINE LEARNING	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 a fundamental knowledge of (A) Artificial Intelligence (AI) (B) Machine Learning (ML) and (C) Mathematics and algorithms related to AI & ML.

Course Outcomes (COs)

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

1. Understand the basic concepts of Artificial Intelligence and search techniques.
2. Apply knowledge representation and logical reasoning.
3. Understand the basic concepts of Machine Learning.
4. Apply linear and logistic regression models.
5. Apply machine learning algorithms and neural networks to solve engineering problems.

Syllabus

Unit – I

(8 Hrs)

Introduction to AI: Definition of AI, types of AI techniques, problem solving using state space search, applying heuristics, hill climbing, search using BFS, DFS.

Unit – II

(8 Hrs)

Knowledge Representation and Logic Programming : Representing knowledge as a rules, representing simple facts in logic, computable functions and predicates, procedural vs declarative knowledge, forward vs backward reasoning, logical programming-predicates logic.

Unit – III

(10 Hrs)

Introduction to Machine Learning and basic concepts: Definition, scope and limitations of ML, basic concepts of regression, probability, statistics and linear algebra for machine learning, basic concepts of convex optimization, data visualization, hypothesis function and testing, data distributions, data preprocessing, data augmentation, normalizing data sets, machine learning models, supervised and unsupervised learning.

Unit – IV

(10 Hrs)

Linear Regression: Model representation for single variable, single variable cost function, gradient decent for linear regression, gradient decent in practice.

Logistic Regression: Hypothesis representation, decision boundary, cost function, optimization, multi classification (one vs all), problem of over-fitting.

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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTCSME501	DSE	ARTIFICAIL INTELLIGENCE AND MACHINE LEARNING	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-V

(9 Hrs)

Supervised and Unsupervised Learning: Discussion on clustering and classification algorithms, Naïve Bayes theorem, decision tree, SVM.

Introduction to Neural Network: Introduction, types of neural network, application in machine learning.

Textbooks:

1. "Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig, 4th Edition, Pearson Education, 2021.
2. "Machine Learning with PyTorch and Scikit-Learn" by Sebastian Raschka, Yuxi (Hayden) Liu and Vahid Mirjalili, 2nd Edition, Packt Publishing, 2022.
3. "Introduction to Machine Learning with Python: A Guide for Data Scientists" by Andreas C. Müller and Sarah Guido, O'Reilly Media, 1st Edition (Latest Available Reprint).
4. "Machine Learning" by Tom M. Mitchell, McGraw-Hill Education, Latest Available Reprint.
5. "Artificial Intelligence" by Elaine Rich, Kevin Knight and Shivashankar B. Nair, 3rd Edition, McGraw-Hill Education, Latest Available Reprint.
6. "Artificial Intelligence for Engineers and Scientists" by John Paul Mueller and Luca Massaron, Wiley, 2021.
7. "Machine Learning in Mechanical Engineering" edited by J. Paulo Davim, De Gruyter, 2022.
8. "Artificial Intelligence in Manufacturing" edited by B. K. Choi and D. H. Noh, Springer, Latest Available Edition.

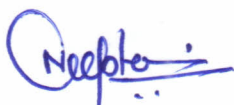
Reference Books:

1. "Machine Learning" by Tom M. Mitchell, McGraw-Hill Education, Latest Available Reprint.
2. "Pattern Recognition and Machine Learning" by Christopher M. Bishop, Springer, 2006 (Latest Available Reprint).
3. "Deep Learning" by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press, 2016.
4. "Artificial Intelligence in Mechanical Engineering" edited by C. H. Dagli, ASME Press, Latest Available Edition.
5. "Machine Learning in Advanced Manufacturing" edited by J. Paulo Davim, Elsevier, 2023.
6. "Machine Learning for Mechanical Engineers" edited by P. K. R. Maddikunta et al., CRC Press, 2024.



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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*				
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 machinery.
4. Gaining knowledge in sources and measurement standard of noise.
5. Ability to design and develop vibrations 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

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

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.

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)

Vibration Control: Sources of vibration and methods of vibration reduction; vibration control through structural design, material selection, localized mass addition, damping and resilient isolation; vibration isolation; vibration absorbers; active and passive vibration control; machine vibration condition monitoring and fault diagnosis.

Textbooks:

1. "Theory of Vibrations with Applications" by W.T. Thomason, M.D. Dahleh and C. Padmanabhan, Pearson, 2011.
2. "Textbook of Mechanical Vibrations", by Dukikipati RV Srinivas J; Publisher PHI, 2017.
3. "Mechanical Vibrations" by S.S. Rao, Pearson, 2018.

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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.

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
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, 2018.

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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COURSE CODE	CATEG ORY	COURSE NAME	TEACHING & EVALUATION SCHEME								
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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 will be able to understand the various modes of heat transfer.
2. Students will be able to analyze the fundamental differences between conduction, convection, and radiation heat transfer.
3. Students will be able to explain the significance of various dimensionless numbers used in convection heat transfer.
4. Students will be able to understand the principles of thermal radiation and its applications.
5. Students will be able to explain the concepts of mass transfer and concentration gradient as the driving potential for mass transfer.

Syllabus

Unit-I

(9 Hrs)

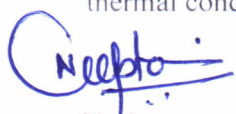
Basic Concepts: Modes of heat transfer, Fourier's law, Newton's law, Stefan Boltzmann law; thermal resistance and conductance, analogy between flow of heat and electricity, combined heat transfer process.

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.

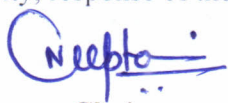
Unit –II

(9 Hrs)

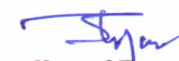
Extended surfaces (fins): Heat transfer from a straight and annular fin (plate) for a uniform cross section; error in measurement of temperature in a thermometer well, fin efficiency, fin effectiveness, applications; Unsteady heat conduction: Transient and periodic conduction, heating and cooling of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

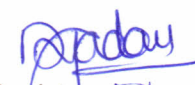

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BTME604	DCC	HEAT AND MASS TRANSFER	60	20	20	30	20	3	1	2	5

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.

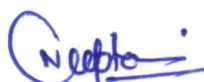
Boiling and condensation: Film wise and drop wise condensation; Nusselt theory for film wise condensation on a vertical plate and its modification for horizontal tubes; boiling heat transfer phenomenon, regimes of boiling, boiling correlations.

Text and References Books:

1. "Heat Transfer" by J. P. Holman, McGraw-Hill Education, 10th Edition, 2010.
2. "Heat and Mass Transfer" by P. K. Nag, McGraw-Hill Education, 4th Edition, 2021.
3. "Heat Transfer: Principles and Applications" by B. K. Dutta, PHI Learning, 2nd Edition, 2021.
4. "Heat Transfer" by A. F. Mills, Pearson Education, 2nd Edition.
5. "Heat and Mass Transfer: Fundamentals and Applications" by Yunus A. Çengel and Afshin J. Ghajar, McGraw-Hill Education, 6th Edition, 2020.
6. "Heat and Mass Transfer" by R. Yadav, Central Publishing House, Latest Revised Edition.
7. "A Textbook on Heat Transfer" by S. P. Sukhatme, Universities Press, 5th Edition, 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. To determine the thermal conductivity of a metallic rod by the steady-state conduction method.
2. To study free convection heat transfer from a vertical extended surface (fin) and determine the heat transfer coefficient.
3. To study forced convection heat transfer over a circular cylinder and determine the heat transfer coefficient.
4. To determine the effectiveness and heat transfer rate of a parallel-flow and counter-flow heat exchanger.
5. To calibrate a thermocouple and determine its temperature–EMF characteristics.
6. To experimentally determine the Stefan–Boltzmann constant using a radiation apparatus.
7. To study the performance of different types of fins under forced convection heat transfer.
8. To study the construction and working of various types of heat exchangers.

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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
(2024 - 2028)

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*				
BTME605	DCC	MACHINE DESIGN II	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 develop the knowledge and skills required for the design and analysis of machine elements, metal working tools and dies, jigs and fixtures, gauges, gears, and I.C. engine components by applying engineering design principles, material selection, and relevant design standards.

Course Outcomes (COs)

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

1. Students will be able to understand the basic concepts of machine design, materials, and theories of failure.
2. Students will be able to design basic metal working tools and dies.
3. Students will be able to design jigs, fixtures, gauges, and moulds for manufacturing applications.
4. Students will be able to design gears and I.C. engine components.
5. Students will be able to apply machine design principles in the design of machine elements.

Syllabus

Unit – I

(10 Hrs)

Introduction to Machine Design: Philosophy of machine design; design procedure; design considerations; material selection for machine elements; IS coding of steels and cast irons; simple and combined stresses in machine elements; theories of failure; factor of safety.

Limits, Fits and Surface Engineering: Limits, tolerances and fits; types of fits and tolerances; design considerations for clearance, transition and interference fits; surface finish, surface roughness and their significance in machine design.

Unit – II

(10 Hrs)

Design of Metal Working Tools and Dies: Introduction to metal working tools and dies; design of press working tools; design of shearing, blanking, piercing and compound dies; design principles of bending, forming and deep drawing dies; tooling and design principles for forging dies, including drop forging and upset forging; fundamentals of rolling and roll pass design; selection of die materials and standard die components.

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Unit – III

(10 Hrs)

Design of Jigs, Fixtures, Gauges and Moulds: Fundamentals and design principles of jigs and fixtures; principles of location and clamping; locating and clamping devices; drilling jigs and drill bushes; design of milling, grinding, broaching and assembly fixtures; indexing jigs, fixtures and indexing devices; economics of jigs and fixtures; design principles of limit gauges for dimensional and geometric tolerances; design of moulds for plastic and rubber components, including compression, transfer and blow moulds.

Unit – IV

(10 Hrs)

Gear Design: Classification of gears; law of gearing; gear terminology; design of spur, helical, bevel and worm gears; Lewis and Buckingham equations; force analysis; dynamic load and wear considerations; selection of gear materials and design considerations

Design of Cylinder and Piston: Material selection for cylinder and piston; design of cylinder, piston, piston pin and piston rings; piston friction, piston slap and lubrication; failure modes and design considerations of piston assembly.

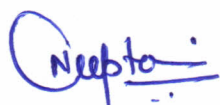
Unit-V

(10 Hrs)

Design of Connecting Rod and Crankshaft: Selection of materials for connecting rod and crankshaft; determination of optimum connecting rod length; design of small end, big end, shank and big end cap bolts; design consideration and failure analysis of connecting rod; balancing of reciprocating and rotating masses in I.C. engines; significance of firing order; design of crankshaft under combined bending and torsional loads; balancing weight calculations and design considerations.

Text and Reference Books:

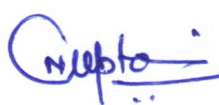
1. "Design of Machine Elements" by V. B. Bhandari, McGraw Hill Education, 4th Edition, 2021.
2. "Machine Design" by P. C. Gope, PHI Learning, Latest Edition.
3. "Machine Design" by R. S. Khurmi and J. K. Gupta, S. Chand Publishing, Latest Revised Edition.
4. "Design of Jigs, Fixtures and Press Tools" by K. Venkataraman, New Age International Publishers, Latest Edition.



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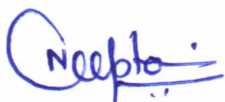
5. "Tool Design" by Cyril Donaldson, George H. LeCain and V. C. Goold, McGraw-Hill Education, 4th Edition.
6. "Fundamentals of Metal Cutting and Machine Tools" by B. L. Juneja, G. S. Sekhon and Nitin Seth, New Age International Publishers, Latest Edition.
7. "Machine Design" by Sadhu Singh, Khanna Publishers, Latest Revised Edition.
8. "Automobile Engineering (Vol. I & II)" by Kripal Singh, Standard Publishers Distributors, 11th Edition, 2014.

Reference Books:

1. "Shigley's Mechanical Engineering Design" by Richard G. Budynas and J. Keith Nisbett, McGraw Hill Education, 11th Edition, 2020.
2. "Machine Elements in Mechanical Design" by Robert L. Mott, Pearson Education, 6th Edition, 2020.
3. "Handbook of Gear Design" by G. M. Maitra, McGraw Hill Education, 2nd Edition.
4. "Vehicular Engine Design" by Kevin Hoag and Brian Dondlinger, Springer, 2nd Edition, 2015.
5. "Manufacturing Engineering and Technology" by Serope Kalpakjian and Steven R. Schmid, Pearson Education, 8th Edition, 2020.
6. "Jigs and Fixture Design Manual" by Erik K. Henriksen, Industrial Press, Latest Edition.

List of Experiments

1. To study the design procedure, material selection, theories of failure, limits, fits and tolerances used in machine design.
2. To design a blanking or piercing die for a given sheet metal component.
3. To design a bending or deep drawing die for a given component.
4. To design a drilling jig for a given workpiece.
5. To design a milling fixture for a given workpiece.
6. To design a limit gauge for a given component based on specified tolerances.
7. To design a spur gear and determine the forces acting on the gear teeth.
8. To design a piston and piston pin for an I.C. engine.
9. To design a connecting rod for an I.C. engine.
10. To design a crankshaft subjected to combined bending and torsional loads.



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BTME606	AESE	SIMULATION OF MECHANICAL SYSTEM LAB	0	0	0	0	50	0	0	2	1

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

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Course Educational Objectives (CEOs)

To develop students' ability to create CAD models, perform assembly design, and analyze mechanical systems using simulation and CAE tools for engineering applications.

Course Outcomes (COs)

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

1. Create CAD models, engineering drawings, and mechanical assemblies.
2. Simulate the motion of mechanical systems and mechanisms.
3. Perform assembly validation and design analysis.
4. Conduct structural and thermal analysis using CAE tools.
5. Evaluate fatigue life and optimize mechanical designs through simulation.

Syllabus

Unit – I

(6 Hrs)

CAD Modelling and Assembly Design: Introduction to CAD-based simulation of mechanical systems; overview of CAD software environment; parametric modelling of mechanical components; creation of 3D models; engineering drawings with dimensions and annotations; assembly modelling; application of assembly constraints; exploded views and assembly animations.

Unit – II

(6 Hrs)

Mechanical System Modelling and Motion Simulation: Introduction to mechanical system simulation; mechanism modelling; kinematic constraints and joints; motion simulation of slider-crank mechanism; four-bar linkage mechanism; displacement, velocity and acceleration analysis; simulation of gear pairs and cam-follower mechanisms.

Unit – III

(6 Hrs)

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Assembly Validation and Design Analysis: Interference detection and collision analysis; mass property analysis; centre of gravity and moment of inertia calculations; design verification of mechanical assemblies; interpretation of simulation results.

Unit – IV

(6 Hrs)

Structural and Thermal Simulation: Introduction to CAE and finite element based simulation; preprocessing, meshing and boundary conditions; static structural analysis; stress, strain and deformation analysis; thermal analysis of mechanical components; interpretation of analysis results.

Unit-V

(6 Hrs)

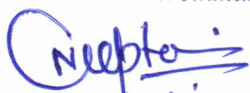
Fatigue Analysis and Project Work: Introduction to fatigue analysis; fatigue loading and failure criteria; estimation of fatigue life and factor of safety; optimization of design parameters; modelling, assembly and simulation of mechanical systems through mini projects.

Textbooks:

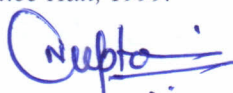
1. "Modeling, Analysis and Control of Dynamic Systems" by W. J. Palm, John Wiley, 1999.
2. "Modeling of Dynamic Systems" by Lennart Ljung and Torkel Glad, Prentice Hall, 2016.
3. "Mathematical Modeling for Design of Machine Components", by Bhonsle, S.R., and Weinmann, K.J., Prentice Hall, 1999.
4. "Engineering Design with SolidWorks" by James D. Bethune, Pearson Education, Latest Edition.
5. "Creo Parametric for Designers" by Prof. Sham Tickoo, CAD/CIM Technologies, Latest Edition.
6. "Finite Element Analysis Using ANSYS" by S. S. Rao, Elsevier, Latest Edition.

Reference Books:

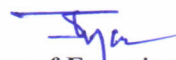
1. "Finite Element Analysis: Theory and Application with ANSYS" by Saad A. Ragab and S. E. Bayoumi, CRC Press, Latest Edition.
2. "ANSYS Workbench Tutorial" by Klaus-Jürgen Bathe / Practical ANSYS Guide, Latest Edition.
3. "Mathematical Modeling for Design of Machine Components" by S. R. Bhonsle and K. J. Weinmann, Prentice Hall, 1999.



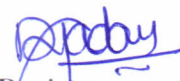
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4. "CATIA V5 for Designers" by Prof. Sham Tickoo, CAD/CIM Technologies, Latest Edition (Only if CATIA is used in lab).

List of Experiments

1. To create 3D models of machine components using CAD software.
2. To prepare detailed engineering drawings of machine components with necessary dimensions and annotations.
3. To create assemblies of machine components using standard assembly constraints.
4. To perform interference detection and mass property analysis of mechanical assemblies.
5. To generate exploded views and assembly animations of mechanical systems.
6. To simulate the motion of a slider-crank mechanism and analyze its kinematic behaviour.
7. To simulate the motion of a four-bar linkage mechanism and analyze displacement, velocity and acceleration.
8. To simulate the motion of gear pairs and cam-follower mechanisms.
9. To perform static structural analysis of mechanical components and evaluate stress, strain and deformation.
10. To perform thermal analysis of mechanical components under specified boundary conditions.
11. To perform fatigue analysis of mechanical components and estimate fatigue life and factor of safety.
12. Mini Project: Modelling, assembly and simulation of a mechanical system.

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