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*				
BTME501A	DSE	CAD CAM CIM	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 provides a fundamental understanding of (A) The Design concepts with the help of computer Application (B) Comprehensive Knowledge of computer applications including geometric, Modeling, Assemblies and Manufacturing.

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 various design concepts with the help of computer application.
2. Familiarized with the computer graphics application in design and understand the basic 2D & 3D commands of CAD and distinguish the CAD from manual paper drafting, in current industrial & product development scenarios.
3. Understand the solid modeling and assembly tools to develop virtual product and part programming and CIM.
4. Understand the CIM and Group Technology and their importance.

Syllabus

Unit – I **(9 Hrs)**

Introduction: Introduction to CAD, Why CAD Software, Scope, objective, benefit, limitation & evaluation; Engineering Design process, Considerations, Formulation Importance, Regulatory and social issues in Indian context; Conceptual Design, Product Design Cycle, Total life cycle and Digital Prototyping.

Unit – II **(9 Hrs)**

Graphics Fundamentals & Standards: Definition, Software configuration of a Graphic system, Functions of a Graphics package, CAD Interface, coordinate system, Creating Basic Drawings, Creating Additional Drawing Objects, Altering Objects, Drawing Organization and Inquiry Commands, Modify and Manipulating Objects, Construction and Reference Geometry, Hatching Objects, Utility Commands, Layers& Blocks, Text, Table & Dimensions, Introducing Printing, Plotting, and Layouts. Database for graphic modeling; PDM, PIM, EDM; define EDM, features of EDM need for CAD data standardization, data exchange formats; GKS, PHIGS, CORE, IGES, DXF STEP DMIS AND VDI; ISO standard for data exchange.

Unit – III **(9 Hrs)**

Geometric Modeling & Assembly: Introduction to Geometric Modeling, Types of models, Construction of

Chairperson	Chairperson	Controller of Examinations	Registrar
Board of Studies	Faculty of Studies	Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth
Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth	Vishwavidyalaya, Indore	Vishwavidyalaya, Indore
Vishwavidyalaya, Indore	Vishwavidyalaya, Indore		

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*				
BTME501A	DSE	CAD CAM CIM	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.

3D Solid Primitives, create 3D Solids from Objects, Extrude, Revolve, Sweep, Loft, Combine or Slice 3D Objects, Move Rotate & Scale 3D Objects, Object Sectioning. Wire frame Models, Curve Representation. Assembly Modeling, Mating conditions, Generation of assembling sequences, basics of boundary presentation- Spline, Bezier, B-Spline, and NURBS; Sculpture and Ruled surfaces, Precedence diagram, Liaison-sequence analysis; Mechanical tolerance: Tolerance concepts, Geometric tolerance, Types of geometric tolerances.

Unit – IV **(9 Hrs)**

Computer-Aided Manufacturing & Part Programming: Computer-Aided Manufacturing, Computer Applications in a Manufacturing Plant, Key Aspects of CAM in a Manufacturing System and Manufacturing Control, G Code & M Code generation through CAD CAM software, Feature Technology, NC, DNC, CNC, NC machine tools: Types of NC machine tools, Automatic tool changes (ATC), Turning centers. ISO codes for turning tools and holders; time and power estimation in milling, drilling and turning.

Unit-V **(9 Hrs)**

Computer Integrated Manufacturing and Group Technology: Introduction to CIM, Scope of Computer integrated Manufacturing; CIM Wheel; Types of Manufacturing systems; Machine tools and related equipment, Material handling systems; Computer control systems, FMS. Importance of batch and job shop production; merits of converting zigzag process layout flow to smooth flow in cellular layout, Production Flow Analysis (PFA) and clustering methods; concept of part families and coding; hierarchical, attribute and hybrid coding; OPITZ, MICLASS and DCLASS coding; FMS; material handling robots, Computer Aided Process Planning (CAPP).

Text and Reference Books:

1. *"Automation, production systems, and computer-integrated manufacturing" by M. P. Groover, Prentice Hall Press, 2007.*
2. *"CAD/CAM/CIM" by P. Radhakrishnan, Subramanian S and Raju V; New Age Pub., 2008.*
3. *"Computer integrated manufacturing: from fundamentals to implementation" by A. Weatherall; Butterworth-Heinemann, 2013.*
4. *"Principles of CIM" by S. Kant Vajpay; PHI, 1995.*
5. *"CAD/CAM" by P.N. Rao, TMH, 2010.*

Chairperson Board of Studies Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	**Chairperson** Faculty of Studies Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	**Controller of Examinations** Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	**Registrar** Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

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*				
BTME501A	DSE	CAD CAM CIM	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.

6. *"CAD/CAM Computer Aided Design and Manufacturing" by Mikell P. Groover and Emory W. Zimmer, 2008.*
7. *"Computer Integrated Design and Manufacturing" by David D. Bedworth, Mark R. Henderson, Philip M. Wolfe, McGraw-Hill, 1991.*
8. *"Mastering CAD", by George Omura with Brian Benton Autodesk, 2004.*
9. *"PTC Creo Parametric 3.0 for Designers" byTickoo S, Textbooks Published by BPB, 2015.*
10. *"SOLIDWORKS 2017 for Designers", by Tickoo S, Textbooks Published by BPB, 2017.*

List of Experiments

The students will be required to carry out the following exercises using educational software (Auto CAD, Creo, Solid works, Master CAM etc).

1. To set up the drawing environment by configuring drawing limits, units, layers, line types, and saving the file in .dwg format using AutoCAD.
2. To prepare the 2D layout of a building using multiple layers and line colors, indicating all building details, adding text annotations, and creating a title block.
3. To draw orthographic projections (front, top, and side views) of standard mechanical components such as a safety valve, knuckle joint, cotter joint, and Plummer block.
4. To generate an isometric drawing with proper dimensions from given orthographic views.
5. To draw various types of bolts and nuts with internal and external threads (Acme and square), and save them as blocks for reuse.
6. To create 3D models using commands such as extrude, revolve, sweep, loft, and other 3D modeling tools.
7. To prepare assembled 3D CAD models of knuckle joint, cotter joint, and Plummer block using any software.
8. To apply motion constraints and simulate mechanisms such as a four-bar chain and piston-cylinder assembly using any CAD tools.
9. To generate G-codes and M-codes for any 3D model using the CAM module of any CAD software.
10. To write a CNC part program using standard G and M codes for machining a given workpiece.

Chairperson
Board of Studies
Shri Vaishnav Vidyapeeth
Vishwavidyalaya, Indore

Chairperson
Faculty of Studies
Shri Vaishnav Vidyapeeth
Vishwavidyalaya, Indore

Controller of Examinations
Shri Vaishnav Vidyapeeth
Vishwavidyalaya, Indore

Registrar
Shri Vaishnav Vidyapeeth
Vishwavidyalaya, Indore

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*				
BTME501B	DSE	FINITE ELEMENT ANALYSIS	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)

The course provides the knowledge of (A) finite element methods. (B) finite element modeling and simulation techniques (C) FEA in structural vibration and thermal Analysis.

Course Outcomes (COs)

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

1. To model and analyze basic structural elements using FEA tools.
2. To perform thermal and axisymmetric analysis using FEA.
3. To analyze fluid flow and vibrations in mechanical systems.
4. To evaluate dynamic response of structures using FEA.

Syllabus

Unit – I **(9 Hrs)**

Basics of FEM: Basic concept of Finite Element Method, Historical background, FEM Applications, General Description of FEM, Commercial FEM software packages, Spring element-stiffness matrix, boundary conditions, solving equations, Variation formulation approach- Rayleigh-Ritz method, Principle of minimum Potential Energy, Weighted residual methods. Initial value and boundary value problems, weighted residual Galerkin and Raleigh Ritz methods-review of Variation calculus, Integration by parts, Basics of variation formulation.

Unit – II **(9 Hrs)**

Element Types and Characteristics: Discretization of the domain, Basic element shapes, Aspect ratio, Shape functions, Generalized co-ordinates and nodal shape functions; ID bar and beam elements, 2D rectangular and triangular elements; axis-symmetric elements.

Unit – III **(9 Hrs).**

Assembly of Elements and Matrices: Concept of element assembly, Global and local coordinate systems, Band width and its effects, Banded and skyline assembly, Boundary conditions, Solution of simultaneous equations, Gaussian elimination and Chloe's decomposition methods, Numerical integration, One and 2D applications

Chairperson Board of Studies Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	**Chairperson** Faculty of Studies Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	**Controller of Examinations** Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	**Registrar** Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

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*				
BTME501B	DSE	FINITE ELEMENT ANALYSIS	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)**

Higher Order and Iso-parametric Elements: One dimensional quadratic and cubic elements, Use of natural co-ordinate system, Area co-ordinate system continuity and convergence requirements, 2D rectangular and triangular requirement.

Unit-V **(9 Hrs)**

Structural Vibration and Dynamic Analysis: Review of basic dynamic equations, Hamilton's principle, element mass matrices, free vibration (normal mode) analysis, Eigen values and Eigen vectors, Introduction to transient response analysis.

Text and Reference Books:

1. *"An introduction to the Finite Element Method" by J. N. Reddy, McGraw Hill Education, 2005.*
2. *"Introduction of Finite elements in Engineering" by Chandrupatla & Belagundu, Pearson, 2011.*
3. *"Finite Element Method in Engineering" by S.S. Rao, Butterworth-Heinemann, 2010.*
4. *"Finite Element Analysis- Theory and Programming" by C. S. Krishnamoorthy, Tata McGraw-Hill Education, 2011.*
5. *"The Finite Element Method" by Zienkiewicz and Taylor, Butterworth-Heinemann, 2000.*
6. *"Concepts and Applications of Finite Element Analysis" by Cook, Robert Davis at al., John Willy & Sons, 2005.*
7. *"The Finite Element Method for Engineers" by K. H. Huebner, D. L. Dewhirst, D. E. Smith and T. G. Byron, John Wiley & Sons, 2001.*

List of Experiments

1. To study the FEA package and perform modeling and stress analysis of trusses.
2. To analyze bars with constant, tapered, and stepped cross-sectional areas.
3. To analyze different types of beams under various loading conditions.
4. To perform stress analysis of a rectangular plate with a circular hole.
5. To analyze axisymmetric problems like pressurized and rotating cylinders (solid and hollow).
6. To perform thermal analysis for 1D and 2D problems with conduction and convection.
7. To analyze fluid flow problems using FEA tools.
8. To perform vibration analysis of structural elements.
9. To conduct dynamic analysis of beam under variable condition.

Chairperson	Chairperson	Controller of Examinations	Registrar
Board of Studies	Faculty of Studies	Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth
Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth	Vishwavidyalaya, Indore	Vishwavidyalaya, Indore
Vishwavidyalaya, Indore	Vishwavidyalaya, Indore		

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Information Technology

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

B. Tech in Mechanical/Automobile 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*				
BTCSME501	DSE	ARTIFICAIL INTELLIGENCE AND MACHINE LEARNING	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 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 Completing the course student should be able to:

1. Understand the artificial intelligence and use.
2. Understand knowledge representation and logic programming and apply it.
3. Understand machine learning and mathematical foundation and principles.
4. Understand Learn various mathematical techniques used in AI & ML.
5. Apply knowledge of computing and mathematics to machine learning problems, models and algorithms.

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,

Chairperson	Chairperson	Controller of Examinations	Registrar
Board of Studies	Faculty of Studies	Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth
Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth	Vishwavidyalaya, Indore	Vishwavidyalaya, Indore
Vishwavidyalaya, Indore	Vishwavidyalaya, Indore		

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore
Shri Vaishnav Institute of Information Technology
Choice Based Credit System (CBCS) Scheme in light of NEP-2020
B. Tech in Mechanical/Automobile 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*				
BTCSME501	DSE	ARTIFICAIL INTELLIGENCE AND MACHINE LEARNING	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.

multi classification (one vs all), problem of over-fitting.

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.

Text Books:

1. *Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer-Verlag New York Inc., 2nd Edition, 2011.*
2. *Tom M. Mitchell, "Machine Learning", McGraw Hill Education, First edition, 2017.*
3. *Ian Good fellow and Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press, 2016.*
4. *Christopher M. Bishop, "Pattern Recognition and Machine Learning" Springer, 2010*

Reference Books:

1. *E. Rich, K. Knight and S. B. Nair, "Artificial Intelligence" McGraw Hill Education, 3rd edition, 2017.*
2. *Francois Chollet, "Deep Learning with Python", Manning Publications, 1st edition, 2018.*
3. *Andreas Muller, "Introduction to Machine Learning with Python: A Guide for Data Scientists", Shroff/O'Reilly, 1st edition, 2016.*
4. *S. Russell and N. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall Series in Artificial Intelligence, 2003.*

List of Experiments

1. Implementation of logic rules in python
2. Apply the concept of linear regression using appropriate data.
3. Apply the concept of gradient regression using appropriate data.
4. Apply the concept of logistic regression using appropriate data.
5. To add missing value in data set.
6. Perform and plot under fitting and over fitting in a data set.
7. Implementation of clustering algorithms.
8. Implementation of classification algorithms.

Chairperson
Board of Studies
Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Chairperson
Faculty of Studies
Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Controller of Examinations
Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Registrar
Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

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*				
BTME502A	DSE	ADVANCED MATERIALS	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):
To introduction and familiar with (A) special steels and their alloys, (B) automation using hydraulic and Pneumatic system (C) automated work handing system (D) applications of automation in manufacturing.

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 concept of automation.
2. Design a Pneumatic and Hydraulic system for a given application.
3. Understand the transfer mechanisms in automation and handling system
4. Demonstrate the use of different sensors for automation.
5. Design an AGV system or automated mechanical system.

Syllabus

Unit – I **(9 Hrs)**
Special Steel and Their Alloys
Metallurgical aspects, properties and applications of different types of stainless steels such as: dual phase steels, trip steels, maraging steels, high speed steels, free cutting steels, ausformed steels, tool steels, manganese steels, chrome steels, electrical steels, bearing steels, spring steels, heat resistant steels, creep steels, HSLA steels etc.,.

Unit – II **(9 Hrs)**
Light Metals and Their Alloys
Need of alloying, Aluminum, magnesium and titanium alloys: Metallurgical aspects, Properties and applications.
Super alloys: Iron base, nickel base and cobalt base super alloys, Composition, Properties and their application

Unit – III **(9 Hrs)**
Nano and Smart Materials
Definition, types, properties and applications, carbon nano tubes, methods of production, shape memory alloys, piezoelectric materials, electro-active polymers, electro-rheological fluid, functionally gradient material (FGM), biomaterials, micro-electro mechanical systems (MEMS).

Chairperson	Chairperson	Controller of Examinations	Registrar
Board of Studies	Faculty of Studies	Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth
Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth	Vishwavidyalaya, Indore	Vishwavidyalaya, Indore
Vishwavidyalaya, Indore	Vishwavidyalaya, Indore		

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*				
BTME502A	DSE	ADVANCED MATERIALS	60	20	20	0	0	3	0	0	**3**

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

Unit – IV **(9 Hrs)**

Composite Materials:

Definition, Classification, Composite Materials and Structures, Processing of metal matrix composites, polymer matrix composites, ceramic matrix composites, behavior of composites, orthotropic and laminated composite, failure of composites.

Unit – V **(9 Hrs)**

Miscellaneous Advanced Materials

Magnetic materials, ceramics, biomaterials, polymers, aerospace materials and cryogenic materials, semi conducting and superconducting materials and their applications. Properties and applications: strength, stiffness, creep, fatigue and fracture; thermal, damping and tribological properties.

Text Books:

1. *"The Science and Engineering of Materials" by Donald R. Askeland, P.P. Fulay and W.J. Wright, Cengage Learning, 2010.*
2. *"Advances in Material Science" by R K Dogra and A K Sharma, S.K. Kataria & Sons, 2003.*
3. *"Engineering Materials: Polymers, Ceramics and Composites" by AK Bhargava, PHI, 2012.*
4. *"Engineering Materials and their Applications" by R. A. Flinn and P. K. Trojan, JPH, 1999.*
5. *"Nano Technology" by A.K. Bandyopadhyay, New Age Int. Pub. 2008.*

Reference Books:

1. *"Smart Materials and Structures" M.V. Gandhi and B.S. Thompson, Chapman and Hall. 1992.*
2. *"Composite Materials, Science and Engineering" by K.K. Chawla, Springer, 2012.*
3. *"Advances in Materials and Their Applications" by P. Rama Rao, New Age International (P) Ltd., Publishers, 2012.*
4. *"Elements of Materials science" by Van Vlack, Pearson, 2002.*

Chairperson	Chairperson	Controller of Examinations	Registrar
Board of Studies	Faculty of Studies	Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth
Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth	Vishwavidyalaya, Indore	Vishwavidyalaya, Indore
Vishwavidyalaya, Indore	Vishwavidyalaya, Indore		

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*				
BTME502B	DSE	ROBOTICS AND MACHINE VISION SYSTEM	60	20	20	0	0	3	0	0	**3**

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

Course Educational Objectives (CEOs):

This course provides a fundamental understanding of (A) mechanical design of robots, various sensors and its application in the area of industrial robotics. (B) Sensors and programming of industrial robots. (C) Applications of vision and challenges involved (D) Impart knowledge on imaging, machine vision and its applications.

Course Outcomes (COs):

After completion of this course the students are expected to be able to

1. Explain the various image processing and image analysis algorithms and the issues involved in applying them to various machine vision applications
2. Apply the basic concepts of optics in imaging.
3. Explain the various hardware components of an imaging system for machine vision applications.

Syllabus

Unit-I

Introduction to Industrial Robots: Definition, types, work envelope-based classifications, generations, configurations, control loops, coordinate systems, parts, functions, and specifications. **Robot Motion & Kinematics:** Types of motion, direct and inverse kinematics, homogeneous transformations, linkages, joints, and object location/orientation methods.

Unit-II

Drive Systems & End Effectors: Types of drives, grippers – types, selection, classification, design, and force analysis.

Sensors & Vision Systems: Position, proximity, tactile, and joint force sensors; vision systems, object recognition, image processing, and safety monitoring.

Unit-III

Robot Programming & AI Techniques: Types of Programming; Teach pendant programming; Basic concepts in AI techniques, Concept of knowledge representations, Expert system and its components; Robotic cell layouts, Inter locks, Humanoid robots, Micro-robots; Application of robots in surgery, Manufacturing industries, space and underwater.

Unit-IV

Image Acquisition: Human vision, Machine and Computer vision, Benefits, Block diagram and

Chairperson	Chairperson	Controller of Examinations	Registrar
Board of Studies	Faculty of Studies	Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth
Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth	Vishwavidyalaya, Indore	Vishwavidyalaya, Indore
Vishwavidyalaya, Indore	Vishwavidyalaya, Indore		

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*				
BTME502B	DSE	ROBOTICS AND MACHINE VISION SYSTEM	60	20	20	0	0	3	0	0	**3**

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

function; Basic components of industrial machine vision; Light behavior, lens basics, lighting techniques, and camera selection; Overview of CCD/CMOS sensors and image formation; Analog and Digital Cameras, Camera Computer Interfaces, Camera calibration.
Image Processing: Introduction to digital images and image processing; Image acquisition modes; Operations like thresholding, smoothing, sharpening, edge detection; Basic color image processing and use of machine vision software.

Unit-V

Machine Vision Analysis & Applications: Feature extraction using region, shape, size, and texture features; basic template matching and classification; 3D machine vision Techniques, decision-making, machine vision applications in manufacturing, electronics, textile, printing, and pharmaceutical industries; applications in non-visible spectrum, OCR/OCV, and vision guided robotics - Field and Service Applications, Agricultural, and Bio medical field, augmented reality, surveillance, bio-metrics.

Text Books:

1. *Mikell P. Groover, Automation, Production Systems, and Computer-Integrated Manufacturing, 4th ed., Pearson, 2021.*
2. *J. J. Craig, Introduction to Robotics: Mechanics and Control, 4th ed., Pearson, 2018.*
3. *Sabrie Soloman, Sensors Handbook, 2nd ed., McGraw Hill, 2020.*
4. *Milan Sonka, Vaclav Hlavac, and Roger Boyle, Image Processing, Analysis, and Machine Vision, 4th ed., Cengage Learning, 2014.*
5. *C. Keyness, Robotics in Manufacturing, 1st ed. New York, NY, USA: Tailored Read, 2023.*

Reference Books:

1. *"Industrial Robotics, technology, programming and application", by Groover. M. P. Mc-Graw Hill book and co. 2012*
2. *R. J. Schilling, Fundamentals of Robotics: Analysis and Control, 2nd ed. New York, NY, USA: Wiley, 2023*
3. *R. K. Mittal and I. J. Nagrath, Robotics and Control, 2nd ed. New Delhi, India: McGraw Hill India, 2022.*
4. *M. P. Groover, Automation, Production Systems, and Computer-Integrated Manufacturing, 5th ed. Upper Saddle River, NJ, USA: Pearson, 2024.*

Chairperson	Chairperson	Controller of Examinations	Registrar
Board of Studies	Faculty of Studies	Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth
Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth	Vishwavidyalaya, Indore	Vishwavidyalaya, Indore
Vishwavidyalaya, Indore	Vishwavidyalaya, Indore		

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*				
BTME502C	DSE	NON-CONVENTIONAL ENERGY SOURCES	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 concepts and knowledge of (a) Solar Energy (b) Wind Energy (c) Bio Energy (d) Ocean Energy & Geothermal Energy.

Course Outcomes (COs):
After learning the course, the students should be able to:

1. Understand the basic concept of renewable energy engineering.
2. Acknowledge, access and analysis various renewable energy system & technology.
3. Evaluate renewable energy related system for a particular application.
4. Collect and organize information on renewable energy technologies as a basis for further analysis and evaluation.

Syllabus

Unit – I **(9 Hrs)**

Introduction: Needs of Renewable Energy, Advantages and Limitations of Renewable Energy, Present energy scenario of conventional and renewable energy sources, Review of energy sources, Present energy consumption/utilisation pattern sector wise in India, Environmental impact of fossil fuels, growth of energy sector and its planning in India.

Unit – II **(9 Hrs)**

Solar Energy: Solar radiation at the earth's surface, solar radiation measurements, estimation of average solar radiation, solar thermal flat plate collectors, concentrating collectors, solar thermal applications; heating, cooling, desalination, drying, cooking, etc, principle of photovoltaic conversion of solar energy, photovoltaic applications. Photovoltaic system for power generation, solar cell modules and arrays, solar cell types, material, applications, advantages and disadvantages

Unit – III **(9 Hrs)**

Wind Energy: Power in the wind, Betz limit, site selection, wind energy conversion devices, characteristics, applications, offshore wind energy, Hybrid systems, safety and environmental aspects, wind energy potential and installation in India. basics of wind energy conversion system, effect of density, angle of attack and wind speed, windmill rotors, horizontal and vertical axes rotors, drag, lift, torque and power coefficients, tip speed ratio, solidity of turbine, wind turbine performance curves, wind energy potential and site selection, basics of wind.

Chairperson	Chairperson	Controller of Examinations	Registrar
Board of Studies	Faculty of Studies	Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth
Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth	Vishwavidyalaya, Indore	Vishwavidyalaya, Indore
Vishwavidyalaya, Indore	Vishwavidyalaya, Indore		

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*				
BTME502C	DSE	NON-CONVENTIONAL ENERGY SOURCES	60	20	20	0	0	3	0	0	**3**

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

Unit - IV **(8 Hrs)**

Bio-Energy: Biomass resources and their classification, biomass conversion processes, thermo chemical conversion, biomass gasification, pyrolysis and liquefaction, biochemical conversion, anaerobic digestion, alcohol production from biomass, bio diesel production, urban waste to energy conversion, biomass energy programs in India.

Unit-V **(10 Hrs)**

Ocean Energy: OTEC principle, open, closed and hybrid cycle OTEC system, Energy from tides, estimation of tidal power, tidal power plants, single and double basin plants, site requirements, advantages and limitations wave energy, wave energy conversion devices, advantages and disadvantages, ocean thermal energy.

Geothermal energy: Introduction, vapor and liquid dominated systems, binary cycle, hot dry rock resources, magma resources, advantages and disadvantages, applications

MHD Power generation: concept and working principle

Text and Reference Books:

1. *"Solar Energy: Principles of Thermal Collection and Storage", by S. P. Sukhatme and J. K. Nayak, McGraw-Hill (2006).*
2. *"Solar Engineering of Thermal Processes", by John A. Duffie, William A. Beckman, John Wiley, New York (2013).*
3. *"Non-conventional energy resources", by Shobh Nath Singh, Pearson India (2015).*
4. *"Solar Energy Engineering", by Soteris Kalogirou, Elsevier/Academic Press (2009).*
5. *"Principles of Solar Energy", by Frank Krieth & John F Kreider, John Wiley, New York (2015).*
6. *"Renewable Energy Engineering and Technology", by Kishore VVN, Teri Press, New Delhi (2010).*

Chairperson	**Chairperson**	**Controller of Examinations**	**Registrar**
Board of Studies	Faculty of Studies	Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth
Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth	Vishwavidyalaya, Indore	Vishwavidyalaya, Indore
Vishwavidyalaya, Indore	Vishwavidyalaya, Indore		

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*				
BTME503	DCC	DYNAMICS OF MACHINE	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 introduce basic principles and applications of (A) Engine Mechanisms, (B) Governor Mechanisms, (C) Balancing of Inertia Forces, Friction and Brakes

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 need of engine mechanisms and displacement, velocity and acceleration of piston.
2. Understand Governor Mechanisms.
3. Understand and analyse Balancing of masses.
4. Understand utility of Friction in Machine parts and lubrication concepts.
5. Students would be able to analyze Cam movement, belt drives and braking.

Syllabus

Unit – I **(8 Hrs)**

Dynamics of Engine Mechanisms: Displacement, velocity and acceleration of piston; turning moment on crankshaft; turning moment diagram; Fluctuation of crankshaft speed; Analysis of flywheel.

Unit – II **(8 Hrs)**

Governor Mechanisms: Types of governors, characteristics of centrifugal governors, gravity and spring controlled centrifugal governors; hunting of centrifugal governors; inertia governors.

Unit – III **(9 Hrs)**

Balancing of Inertia Forces: Balancing of rotating masses; Two plane balancing; Determination of balancing masses (graphical and analytical methods); Balancing of rotors; Balancing of internal combustion engines, Single cylinder engines, In-line engines, V-twin engines, Radial engines, Lanchester technique of engine balancing.

Unit – IV **(9 Hrs)**

Friction: Frictional torque in pivots and collars by uniform pressure and uniform wear rate criteria, Boundary and fluid film lubrication, friction in journal and thrust bearings, concept of friction circle and axis, rolling friction.

Chairperson	Chairperson	Controller of Examinations	Registrar
Board of Studies	Faculty of Studies	Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth
Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth	Vishwavidyalaya, Indore	Vishwavidyalaya, Indore
Vishwavidyalaya, Indore	Vishwavidyalaya, Indore		

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*				
BTME503	DCC	DYNAMICS OF MACHINE	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-V **(10 Hrs)**

Belt drives: Velocity ratio, limiting ratio of tension; power transmitted; centrifugal effect on belts; maximum power transmitted by belt; initial tension; creep; chain and rope drives.
Brakes: Band brake; Band and block brakes, Internal and external shoe brakes.
Dynamometer: Different types and their applications.
Dynamic Analysis of Cams: Response of un-damped cam mechanism (analytical method), follower response analysis by phase-plane method, jump and cross-over shock.

Text and Reference Books:

1. *"Theory of machines", by Rattan; Publisher: TMH, 2009.*
2. *"Mechanism and Machine Theory", by Ambekar; Publisher: PHI, 2007.*
3. *"Theory of Machines", by Thomas Bevan; Publisher: Pearson, 2010.*
4. *"Theory of Mechanisms and Machines", by Ghosh and Malik; East-West Press, 2015.*
5. *"Kinematics and dynamics of machinery", by Norton RL; Publisher: TMH, 2009.*
6. *"Theory of Machines", by P.L. Balaney; Publisher: Khanna, 2003.*

List of Experiments

1. To perform an experiment on Watt and Porter Governors and prepare performance characteristic curves to determine stability and sensitivity.
2. To perform an experiment on Proell Governor and prepare performance characteristic curves to determine stability and sensitivity.
3. To perform an experiment on Hartnell Governor and prepare performance characteristic curves to determine stability and sensitivity.
4. To determine the gyroscopic couple using a motorized gyroscope.
5. To study gyroscopic effects through demonstration models.
6. To study the concept of a dynamically equivalent system.
7. To study different types of dynamometers.
8. To study different types of clutches.
9. To study different types of brakes.
10. To study the dynamic behavior of a cam and follower under various operating conditions using CAM analysis apparatus.

Chairperson	Chairperson	Controller of Examinations	Registrar
Board of Studies	Faculty of Studies	Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth
Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth	Vishwavidyalaya, Indore	Vishwavidyalaya, Indore
Vishwavidyalaya, Indore	Vishwavidyalaya, Indore		

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*				
BTME509	DCC	SQC AND TOTAL QUALITY MANAGEMENT	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):
To introduction with (A)Modern quality control techniques to include the design of statistical process control systems, (B) Acceptance sampling and process improvement, (C) Quality Principles, Tools and Techniques.

Course Outcomes (COs):
After completion of this course

1. Student would be able to understand the need of quality, and its concepts.
2. Student would be able to understand various available statistical tools of quality control.
3. Student would be able to analyses basics of quality management and able to understand various management tools and techniques.
4. Students would be able to understand the statistical and economical design issues associated with the monitoring tools.
5. Students will be able to understand the basics of quality function deployment and its tools and techniques.

Syllabus

Unit I **(9 Hrs)**

Introduction of Statistical quality Control & TQM

Quality: Definition, need, evolution, The Meaning of Quality and Quality Improvement; Brief History of Quality Methodology; Statistical Methods for Quality Control and Improvement; Total Quality Management: quality philosophies (Contributions of Deming, Juran and Crosby, links between quality and productivity, quality costs legal aspects of quality implementing quality improvement).

Unit II **(10 Hrs)**

Methods and Philosophy of Statistical Process Control

Chance and assignable causes, Statistical Basis of the Control Charts (basic principles, choices of control limits, sample size and sampling frequency, rational subgroups, analysis of pattern on control charts, warning limits, ARL, sensitizing rules for control charts); Deming's Magnificent Seven Implementing SPC; An Application of SPC; Nonmanufacturing application of SPC.

Unit III **(9 Hrs)**

Control Charts for Variables

Control Charts for $\bar{X}$ and R (statistical basis, development and use, estimating process capability;

Chairperson	Chairperson	Controller of Examinations	Registrar
Board of Studies	Faculty of Studies	Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth
Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth	Vishwavidyalaya, Indore	Vishwavidyalaya, Indore
Vishwavidyalaya, Indore	Vishwavidyalaya, Indore		

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*				
BTME509	DCC	SQC AND TOTAL QUALITY MANAGEMENT	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.

interpretation, the effect of non-normality on the chart, the OC function, and average run length); Control Charts for $\bar{X}$ and S; Control Chart for Individual Measurements; Applications of Variables Control Charts.

Unit IV **(9 Hrs)**

Inferences about Process Quality

Sampling distributions, estimation and confidence interval for process parameter(s), hypothesis testing on process parameter(s) and power analysis, Process Capability Ratios, Process Capability Analysis, Exponentially Weighted Moving Average Control Chart, Moving Average Control Chart

Unit V **(8 Hrs)**

TQM Tools & Techniques

Seven traditional tools of quality, new management tools, Six-sigma: Concepts, methodology, application to manufacturing, service sector including IT, Bench marking: reason, process. FMEA, Just-In-Time, Kanban system MRP vs JIT system, Waste elimination, workers involvement through JIT. QFD, Taguchi quality loss function, Inspection: acceptance sampling, OC curve, producer and consumer risk, theoretical invalidation of AS, kp rule for stable and chaotic processes.

Change Management: Introduction, Types, need, scope, diagnosing organizational change, implementing changes, evaluating change.

Text and Reference Books:

1. *Introduction of Statistical Quality Control" by Douglas C. Montgomery, John Wiley & Sons, 2009*
2. *"Statistical Quality Control" by E.L. Grant and R.S. Leavenworth, McGraw-Hill publisher, 2000.*
3. *"Principles of Quality Control", by Jerry Banks, Wiley publisher, 1999.*
4. *"Total Quality Management" by D. H. Besterfiled, Pearson Education Asia, Third Edition, Indian Reprint, 2006.*
5. *"The Management and Control of Quality" by J. R. Evans and W. M. Lindsay; South-Western (Thomson Learning), Sixth Edition, 2005.*
6. *"Total Quality Management" by Naidu, Babu and Rajendran; New age international pub; First Edition Reprint, 2013.*

Chairperson	Chairperson	Controller of Examinations	Registrar
Board of Studies	Faculty of Studies	Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth
Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth	Vishwavidyalaya, Indore	Vishwavidyalaya, Indore
Vishwavidyalaya, Indore	Vishwavidyalaya, Indore		

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 AU/ME/CE/EE/EEE/EC/EC-IOT/EI/R&A/MT

(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*				
BTME510	AESE	DESIGN THINKING AND INNOVATION	60	20	20	0	0	2	0	0	**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):
The objective of this course is to provide (A) the new ways of creative thinking and learn the innovation cycle of design thinking process, (B) understand product design and prototyping and (C) develop innovative product.

Course Outcomes (COs):
After completion of this course student will able to

1. To apply learning styles and memory techniques in engineering education.
2. To analyze emotions for designing user-centered products.
3. To use creative thinking and design thinking for innovation.
4. To propose and develop real-time innovative product prototypes.
5. To understand individual differences and enhance customer experience.

Syllabus

Unit I **(6 Hrs)**

Learning: understanding the learning process, Kolb's learning styles, assessing and interpreting.
Memory: understanding the memory process, problems in retention, memory enhancement techniques.
Emotions: understanding emotions, experience & expression, assessing empathy, application with peers.

Unit II **(6 Hrs)**

Design Thinking: definition, need, objective, concepts & brainstorming, stages of design thinking process (explain with examples) – empathize, define, ideate, prototype, test.
Creative Thinking: understanding creative thinking process, understanding problem solving, creative problem-solving test.

Unit III **(6 Hrs)**

Product Design: process of engineering product design, design thinking approach, stages of product design, examples of best product designs and functions, assignment – engineering product design.

Chairperson	Chairperson	Controller of Examinations	Registrar
Board of Studies	Faculty of Studies	Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth
Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth	Vishwavidyalaya, Indore	Vishwavidyalaya, Indore
Vishwavidyalaya, Indore	Vishwavidyalaya, Indore		

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 AU/ME/CE/EE/EEE/EC/EC-IOT/EI/R&A/MT

(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*				
BTME510	AESE	DESIGN THINKING AND INNOVATION	60	20	20	0	0	2	0	0	**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.

Prototyping: What is prototype? Why prototype? Rapid prototype development process, testing, sample example, test group marketing

Unit IV **(6 Hrs)**

Celebrating the Difference: understanding individual differences & uniqueness, group discussion and activities to encourage the understanding, acceptance and appreciation of individual differences
Customer Centricity: practical examples of customer challenges, use of design thinking to enhance customer experience, parameters of product experience, alignment of customer expectations with product design.

Unit V **(6 Hrs)**

Feedback, Re-design & Re-create: feedback loop, focus on user experience, address "ergonomic challenges, user focused design, rapid prototyping & testing, final product, final presentation – **"solving practical engineering problem through innovative product design & creative solution".**

Text and Reference Books:

1. *E. Balaguruswamy "Developing Thinking Skills (The way to Success)" Khanna Book Publishing Company, 2022.*
2. *Gavin Ambrose and Paul Harris "Basics Design 08: Design Thinking" Bloomsbury Publishing India Pvt. Ltd. 2009.*
3. *Vijay Kumar "101 Design Methods: A Structured Approach for Driving Innovation in Your Organization" Wiley Pub. 2012.*
4. *Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons 2013.*
5. *Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve – Apply", Springer, 2011*
6. *Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press, 2009.*

Chairperson	Chairperson	Controller of Examinations	Registrar
Board of Studies	Faculty of Studies	Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth
Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth	Vishwavidyalaya, Indore	Vishwavidyalaya, Indore
Vishwavidyalaya, Indore	Vishwavidyalaya, Indore		

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*				
BTME506	AESE	PROTOTYPING LAB	0	0	0	30	20	0	0	2	1

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) The Design concepts with the help of computer and software (B) Comprehensive Knowledge of computer applications including geometric, Modeling, Assemblies and Manufacturing (C) concepts of rapid prototyping and its applications.

Course Outcomes (COs):
After completion of this course

1. To understand the basic functions of CAD software and apply geometric modeling techniques.
2. To perform 2D and 3D modeling using curves, surfaces, and solid modeling methods.
3. To convert CAD models into STL format and understand their use in rapid prototyping.
4. To study basic rapid prototyping machines like FDM and understand their working principles.

Syllabus

Unit – I

Introduction: Basics of Computer Graphics in CAD/CAM, graphic workstation setup, GUI, parametric programming, 2D & 3D transformations (translation, rotation, scaling, etc.), and projections.

Unit – II

Curves: Modeling planar and space curves, analytical and synthetic approaches, non-parametric and parametric equations.

Surfaces: Modeling of bi-parametric freedom surfaces, Coons, Bezier, B-spline, and NURBS surfaces; surface manipulation techniques.

Unit – III

Geometric Modeling: Geometric modeling techniques, wireframe modeling, solid modeling: B-Rep, CSG, hybrid modelers, feature based, parametric and variational modeling.

Data Structure in Computer Graphics: Introduction to product data standards and data structures, data-base integration for CIM.

Unit – IV

Introduction to Rapid Prototyping: History, Development of RP systems, Applications in Product Development, Reverse Engineering, Rapid Tooling, Rapid Manufacturing Principle, Fundamental; File format, applications of RP.

Chairperson	Chairperson	Controller of Examinations	Registrar
Board of Studies	Faculty of Studies	Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth
Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth	Vishwavidyalaya, Indore	Vishwavidyalaya, Indore
Vishwavidyalaya, Indore	Vishwavidyalaya, Indore		

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*				
BTME506	AESE	PROTOTYPING LAB	0	0	0	30	20	0	0	2	**1**

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

Liquid Based and Solid Based Rapid Prototyping Systems:
Classification, Liquid based system; Stereo-Lithographic Apparatus (SLA), details of SL process; products, Advantages, Limitations, Applications and Uses. Solid based system; Fused Deposition Modeling, principle, process, products, advantages, applications and uses.

Text and Reference Books:

1. *"Geometric Modeling" by V Mortenson, M. E., 3rd Ed., Industrial Press, 2006.*
2. *"Additive manufacturing technologies (Vol. 17)" by Gibson, I., Rosen, D.W. and Stucker, B., Springer, NY, 2014.*
3. *"Surface Modeling for CAD/CAM", by Choi, B. K., John Wiley & Sons, 2001.*
4. *"Automation, production systems, and computer-integrated manufacturing" by M. P. Groover, Prentice Hall Press, 2007.*
5. *"CAD/CAM" by P.N. Rao, TMH, 2010.*
6. *"CAD/CAM Computer Aided Design and Manufacturing" by Mikell P. Groover and Emory W. Zimmer, 2008*
7. *"Rapid Manufacturing – An Industrial revolution for the digital age", by N. Hopkinson, R.J.M, Hauge, P M, Dickens, Wiley, 2006,*

List of Experiments

1. To study the interface and tools of a CAD software for modeling and graphic visualization.
2. To perform 2D and 3D geometric transformations using CAD tools.
3. To create and analyze 2D curves (Bezier, B-spline) using parametric modeling techniques.
4. To create a 3D solid model of mechanical components using basic CAD features.
5. To model 3D surfaces using Coons, B-spline, and NURBS surface techniques.
6. To develop 3D solid models using wireframe, B-Rep, and CSG modeling techniques.
7. To study and implement feature-based parametric modeling for mechanical components.
8. To convert CAD models into STL format for rapid prototyping and understand file preparation.
9. To study the working principle of FDM (3D Printer) through a live demo or video.
10. To study various rapid prototyping methods (SLA, LOM, FDM) using charts or models.
11. To understand reverse engineering basics by scanning a simple object and viewing it in CAD.

Chairperson	Chairperson	Controller of Examinations	Registrar
Board of Studies	Faculty of Studies	Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth
Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth	Vishwavidyalaya, Indore	Vishwavidyalaya, Indore
Vishwavidyalaya, Indore	Vishwavidyalaya, Indore		

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*				
BTME507	DCC	METAL CUTTING AND CNC LAB	0	0	0	30	20	0	0	2	**1**

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):

The objective of this course is to provide **(A)** familiarity with metal cutting machines and their operations, **(B)** hands-on skills in conventional machining processes, and **(C)** a foundational understanding of CNC machines, their applications, and programming techniques.

Course Outcomes (COs)

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

1. Understand and perform various operations on lathe machines
2. Understand and perform various operations on milling and drilling machines
3. Understand and perform various operations on shaping and grinding machines
4. Understand the basic principle, structure and sensors and systems of NC, DNC and CNC
5. Familiar with part programming codes and making of programs

Syllabus

Unit-I:

Safety in Machine Shop- Introduction, personal responsibility, causes of accidents, common sources of accidents, preventive measures, and common safety methods.

Lathe: Classification of machine tools and their basic components; lathe- specification, components & accessories, various operations on lathes, capstan & turret lathes, tool layout, methods of thread production, machining time, single point cutting tools, tool signature and nomenclature.

Unit-II:

Milling: Vertical, horizontal and universal type machines, specifications and classifications of milling machines, universal dividing head plain and different indexing, milling cutters etc.

Drilling: Drilling operations, types of drilling machines; fixed spindle, radial and universal drilling machines, drilling time.

Unit-III:

Grinding: Types of grinding machines, surface, cylindrical and internal grinding, grinding wheels, specifications, wheel turning and dressing without eccentricity, centre-less grinding.

Chairperson	Chairperson	Controller of Examinations	Registrar
Board of Studies	Faculty of Studies	Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth
Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth	Vishwavidyalaya, Indore	Vishwavidyalaya, Indore
Vishwavidyalaya, Indore	Vishwavidyalaya, Indore		

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*				
BTME507	DCC	METAL CUTTING AND CNC LAB	0	0	0	30	20	0	0	2	**1**

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:

Introduction of NC & CNC: Historical background, principle & basic components of NC, DNC and CNC, differences between NC, DNC and CNC, Classification, Evolution of CNC Technology, advantages, disadvantages and applications of NC, DNC and CNC.

Basic details of CNC structure, different drive and control devices and systems of CNC machines. Various cutting tools and its parameters

Unit-V:

Programming: Basics of CNC machine programming, structure of part programming, preparatory functions (G)-motion, dwell, unit, preset, cutter compensation, coordinate and plane selection groups; miscellaneous (M) codes and other codes, part programming for turning, milling etc. Operations on CNC lathe and CNC Milling.

Text and Reference Books:

1. *"Workshop Technology" by W. A. J. Chapman part I, II & III, 5th ed., 2001.*
2. *"Manufacturing Technology" by P. N. Rao, Vol. 1 and 2, 2018.*
3. *"Computer Numerical Control Machines", by Radhakrishnan P, New Age Publication, 2012.*
4. *"CAD/CAM", by Rao P.N., TMH, New Delhi, 2005.*
5. *"Mechatronics", by HMT Ltd., Tata McGraw-Hill Publishing Company Limited, New Delhi.*
6. *"Computer Numeric Control", by Warren S. Seamers, Fourth Edition, Thomson Delmar, 2008*
7. *"CNC Machining Hand Book", by James Madison, Industrial Press Inc., 2006.*
8. *"Programming of CNC Machines", by Ken Evans, John Polywka & Stanley Gabrel, Second Edition, Industrial Press Inc, New York, 2007*
9. *"CNC Programming Hand book", by Peter Smid, Industrial Press Inc., 2010*

List of Experiments:

1. To study machine shop safety rules and identifies common accident causes and preventive measures.
2. To study lathe machine components, tools, and operations (facing, turning, threading, taper turning, etc.).

Chairperson	Chairperson	Controller of Examinations	Registrar
Board of Studies	Faculty of Studies	Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth
Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth	Vishwavidyalaya, Indore	Vishwavidyalaya, Indore
Vishwavidyalaya, Indore	Vishwavidyalaya, Indore		

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*				
BTME507	DCC	METAL CUTTING AND CNC LAB	0	0	0	30	20	0	0	2	**1**

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. To perform multiple operations on a lathe machine such as turning, step turning, drilling, taper turning, thread cutting, and knurling on a single job.
4. To study horizontal/universal milling machines along with dividing head and indexing mechanism and demonstrate indexing operation.
5. To study and operate a radial drilling machine and prepare a job with precise hole dimensions.
6. To study centreless and tool & cutter grinding machines, and understand their working principles and applications.
7. To study the basics and components of NC, DNC, and CNC machines, including their drive systems, control units, and feedback mechanisms.
8. To understand CNC programming structure, G-codes, M-codes, and simulate basic CNC turning and milling operations.
9. To develop and simulate at least five CNC part programs (turning/milling) and identify/correct syntax or logic errors.
10. To write and execute a CNC lathe program for facing, step turning, and taper turning operations and prepare the job.
11. To write and execute a CNC milling program for operations like engraving ("SVVV Indore") and pocketing (circular/rectangular) on a given workpiece.

Chairperson
Board of Studies
Shri Vaishnav Vidyapeeth
Vishwavidyalaya, Indore

Chairperson
Faculty of Studies
Shri Vaishnav Vidyapeeth
Vishwavidyalaya, Indore

Controller of Examinations
Shri Vaishnav Vidyapeeth
Vishwavidyalaya, Indore

Registrar
Shri Vaishnav Vidyapeeth
Vishwavidyalaya, Indore