# Vidya Pratishthan's
# Kamalnayan Bajaj Institute of Engineering and Technology, Baramati.

**(An Autonomous Institute)**

# Faculty of Science and Technology

# Board of Studies

# Mechanical Engineering

# Syllabus

# Double Minor with Specialization in Digital Manufacturing & Robotics

(Pattern 2023)
(w.e.f. AY: 2024-25)

## Syllabus: Double Minor with specialization in Digital Manufacturing & Robotics
### (Pattern 2023)   w.e.f. AY:2024-2025

| Course Code | Courses Name | Teaching Scheme | | | Examination Scheme and Marks | | | | | | | Credits | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | TH | PR | TUT | ACT | ISE | ESE | TW | PR | OR | Total | TH | PR | TUT | Total |
| ME23261 | 3D Modeling & Drafting | 2 | 2 | - | 10 | 20 | 50 | 20 | 20 | - | 120 | 2 | 1 | - | 3 |
| ME23271 | Principle of Robotics | 2 | 2 | - | 20 | 20 | 50 | 20 | 20 | - | 130 | 2 | 1 | - | 3 |
| ME23361 | Digital Manufacturing | 3 | 2 | - | 20 | 20 | 70 | 20 | 20 | - | 150 | 3 | 1 | - | 4 |
| ME23371 | Control System | 3 | 2 | - | 20 | 20 | 70 | 20 | 20 | - | 150 | 3 | 1 | - | 4 |
| ME23461 | Smart Manufacturing | 3 | 2 | - | 20 | 20 | 70 | 20 | 20 | - | 150 | 3 | 1 | - | 4 |
| | Total | 13 | 10 | - | 90 | 100 | 310 | 100 | 100 | - | 700 | 13 | 5 | - | 18 |

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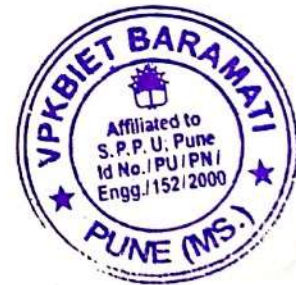
| ME23261:- 3D Modeling & Drafting | | |
|---|---|---|
| **Teaching Scheme:** | **Credits:03** | **Examination Scheme:** |
| **TH: 02 Hrs/Week** | **Theory : 02** **Practical : 01** | **Course Activity: - 10 Marks** |
| | | **In-Semester Exam: 20 Marks** |
| | | **End-Semester Exam: 50 Marks** |
| **PR: 02 Hrs/Week** | | **PR Exam: - 20 Marks** |
| | | **Term-Work: 20 Marks** |

**Prerequisites:** Engineering Graphics.

**Objectives:**

1. Familiarize students with the interface and basic tools of solid modeling software (e.g., SolidWorks, AutoCAD and CATIA).
2. Enable students to create detailed 3D models of mechanical parts from technical drawings.
3. Teach students to assemble individual parts into a complete mechanical assembly.
4. Introduce students to advanced modeling techniques such as surfacing.

**Course Outcomes:**

The students will be able to learn:

**CO1:** Demonstrate the ability to use solid modeling software to create accurate 3D models of mechanical components.

**CO2:** Interpret and convert technical drawings into 3D models for engineering applications.

**CO3:** Apply principles of geometric modeling to develop detailed parts and assemblies

**CO4:** Utilize advanced features and tools of solid modeling software to enhance and optimize designs.

### Course Contents

| Unit-1: Introduction | [06 Hrs.] |
|---|---|
| Introduction – the evolution of CAD, the importance of CAD in the light of allied technologies, Product Life Cycle, CAD tools in the design process of Product Cycle, Computer-Aided Design - Features, requirements, and applications 3D Modeling approach - Types of Geometric models - extrusions, axisymmetric, 3D objects, the difference between wireframe, surface & solid modeling. | |

| Unit-2: Curves and Surfaces | [06 Hrs.] |
|---|---|

Methods of defining Point, Line and Circle, Curve representation - Cartesian and Parametric space, Analytical and Synthetic curves, Parametric equation of line, circle, ellipse.

Synthetic Curves - Hermit Cubic Spline, Bezier, B-Spline Curve,

Surfaces: Surface representation, Types of Surfaces, Bezier, B-Spline, NURBS Surface, Coons patch surface, Surface Modeling.

| Unit-3: Solid Modeling and Assembly | [06 Hrs.] |
|---|---|

Introduction, Geometry, and Topology, Solid entities, Solid representation, Fundamentals of Solid modeling, Boundary representation (B-Rep), Constructive Solid Geometry (CSG), Sweep representation, Analytical solid modeling, Parametric solid modeling, feature-based modeling, Introduction to Assembly Modeling, Assemblies (Top-down and Bottom-up approach).

| Unit-4: Geometric Transformation | [06 Hrs.] |
|---|---|

Introduction, Geometric Transformations, Translation, Scaling, Rotation, Reflection/Mirror, Shear, Homogeneous Transformation, Inverse Transformation, Concatenated Transformation (limited to 2D objects with maximum 3 points only), Coordinate systems - Model (MCS), Working (WCS), Screen (SCS) coordinate system, Mapping of coordinate systems.

**Text Books**:

1. Zeid, I and Sivasubramania, R., (2009), "CAD/CAM : Theory and Practice", 2nd edition, McGraw Hill Education, ISBN-13: 978-0070151345
2. Rao, P. N., (2017), "CAD/CAM: Principles and Applications", 3rd edition, McGraw Hill Education, ISBN-13: 978-0070681934.

**Reference Books:**

1. Ostrowsky, O., Engineering Drawing with CAD Applications, ELBS, 1995

2. Vukašinovic, Nikola and Duhovnik, Jože, (2019), "Advanced CAD Modeling: Explicit, Parametric, Free-Form CAD and Re-engineering", Springer, ISBN-13: 978-3030023980

3. Hearn, D. D. and Baker, M. P., (2013), "Computer Graphics with OpenGL", 4th edition, Pearson Education India, ISBN-13: 978-9332518711

4. Bucalo, Joe and Bucalo, Neil, (2007), "Customizing SolidWorks for Greater Productivity", Sheet Metal Guy, LLC, ISBN-13: 978-0979566608

5. Programming Manuals of Softwares.

**Guidelines for Lab /TW Assessment (All Practical's are compulsory)**

1. **Introduction to Solid Modeling Software:**
   a. Familiarization with the software interface.
   b. Basic commands and tools.
   c. Creating simple geometric shapes.

2. **Creating 3D Models from Technical Drawings:**
   a. Converting 2D sketches into 3D models.
   b. Applying dimensions and constraints.
   c. Editing and modifying models.

3. **Assembly Modeling:**
   a. Importing and assembling individual parts.
   b. Applying mates and constraints.
   c. Checking for interferences and alignments.

4. **Advanced Modeling Techniques:**
   a. Introduction to surfacing and creating simple shapes.

5. **Technical Drawing and Documentation:**
   a. Generating 2D technical drawings from 3D models.
   b. Adding annotations, dimensions, and tolerances.

**Guidelines for Activity:**

**Mini Project:** Applying all learned techniques to design a mechanical component or assembly.