

Bangladesh University of Engineering & Technology

Department of Industrial and Production Engineering

Course Details

Course ID: IPE 409

Title: CAD/CAM (3 credit hours)

Course Teacher(s): Dr. Abdullahil Azeem and Dr. Nafis Ahmad

Description: With the advancement of technology, knowledge of Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM) has become a prerequisite for product design and automated manufacturing systems. This course is designed to introduce the students with the basics of CAD/CAM systems to develop their knowledge in various relevant topics in this field.

Syllabus (2010): CAD: Fundamental concepts, application, hardware and software, types of CAD systems, common 2D CAD software features, basic 3D CAD features.

CAM: fundamental concepts, the trend of development of NC, principles of NC, types of NC systems and machines, NC manual part programming, CNC part programming using APT language, interfacing CAM software with CNC machines, implementing the CAD/CAM system principles of FMS.

Robotics: industrial Robots, robot anatomy (structure) and robot configuration, robot drive and control systems, robot sensors, robot applications.

Outcomes: After the completion of the course, the students will have the ability to-

1. Explain the mathematical basis and underlying theory of modeling used in modern Computer Aided Design techniques and the use of models in different engineering applications.
2. Use parametric modeling techniques to reflect engineering requirements and comprehend interactive computer graphics and data storage system.
3. Design new models of engineering systems in groups and demonstrate a different aspect of their design.
4. Explain the basic concepts of CNC programming and machining.
5. Formulate and solve engineering design problems using modern Computer Aided Design and automated manufacturing problems using Computer Aided Manufacturing techniques
6. Recognize the rapid changes in design and manufacturing, driven by continuously evolving computational infrastructure, which emphasizes the need for continuous learning
7. Communicate effectively the geometry and intent of design features in standard format.
8. Design, develop and program robot arm for industrial applications.

Reference Books:

1. *CADCAM principles, practice and manufacturing management* By Chris McMohan & Jimmie Browne
2. *CAD/CAM Theory and Practice* By Ibrahim Zeid & R. Sivasubramanian
3. *CNC Technology and Programming*, By Steve Krar & Arthur Gill

Lecture Plan [IPE-409 (CAD/CAM)]

Lectures	Topics (CAD)
1	Introduction to CAD
2-3	The design process, Role of modeling and communication, Types of design model, Application of design model, Concurrent engineering, Modelling using CAD, CAD system architecture
4	Defining the Model: Established design representations, Strengths, and weaknesses of conventional representations, The computer representation of drawings and diagrams
5-6	Three-dimensional modeling scheme (Wireframe geometry, The surface representation scheme, Solid modeling)
7	Techniques for Geometric Modelling: Representation of curves, Parametric representation of geometry, Parametric cubic polynomial curves
8	Explanation, deriving equations for Hermite cubic curve, blending functions and discussion on mathematical problems.
9	Bézier curves, General consideration for multi-variable curve fitting
10-11	Overview of Cubic spline curves, B-spline curves, Rational curves, Techniques for surface modeling, surface patch, Bézier surfaces, B-spline surfaces
12-13	Techniques for volume modeling (Boundary representation models, Constructive solid geometry, Other modeling techniques)
14	Class Test-1
15-16	Elements of Interactive Computer Graphics: Introduction to computer graphics, Computer graphics hardware, display devices, Link between computer and display, hard copy devices
17-18	Two-dimensional computer graphics (Vector generation, Windowing transformation, Clipping, Line drawing)
19-20	Three-dimensional computer graphics (viewing transformations). Overview of techniques for visual realism
21	Class Test-2
22	Entity manipulation and Data Storage: Manipulation of the model, Object transformations
23-24	Introduction to model storage, Data structure for interactive modeling, Graphics and computing standards, Data exchange standards
25-28	Industrial robot structure and programming for industrial applications
CAM	
29	Introduction to CAM, NC and CNC machines, Data storage media, CNC axes of motions
30-31	Tool positioning, Word address programming
32-33	Common Programming format and procedure, Linear and Circular Interpolation
34-35	Typical work holding devices, Phase change fixtures
36	Part origin setup, Tool length offset
37	CNC position and motion control system, Stepper and Servo motors, Leadscrews
38-39	CNC machining centers, Automatic tool changer, Pallet work changer
40	CMM principles and scopes, Types of probes and measurement mechanism, Design philosophy
41-42	CNC machine practice in Lab