Noida Institute of Engineering and Technology
Greater Noida
(An Autonomous Institute)

NOIDA INSTITUTE OF ENGG. & TECHNOLOGY, GREATER NOIDA, GAUTAM BUDDH NAGAR

(AN AUTONOMOUS INSTITUTE)

Affiliated to

DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY UTTAR PRADESH, LUCKNOW

Evaluation Scheme & Syllabus

For
Bachelor of Technology
Mechanical Engineering

First Year

(Effective from the Session: 2024-25)

Noida Institute of Engineering and Technology
Greater Noida
(An Autonomous Institute)

Bachelor of Technology
Mechanical Engineering

EVALUATION SCHEME

SEMESTER-I

Sl. No.	Subject code	Subject	Periods			Evaluation Schemes				End Semester		Total	Credit
			L	T	P	CT	TA	TOTAL	PS	TE	PE		
3 WEEKS COMPULSORY INDUCTION PROGRAM													
1		Engineering Mathematical-I	3	1	0	30	20	50		100		150	**4**
2		Basic Electrical and Electronics Engineering	3	0	0	30	20	50		100		150	**3**
3		Foreign Language	2	1	0	30	20	50		50		100	**3**
4		Problem Solving using Python	0	0	6				50		100	150	**3**
5		CAD and Digital Manufacturing	0	0	6				50		100	150	**3**
6		Basic Electrical and Electronics Engineering Lab	0	0	2				25		25	50	**1**
7		Acquiring Business Communication (ABC) Lab	0	0	6				50		100	150	**3**
8		Essence of Indian Traditional Knowledge /Constitution of India, Law and Engineering/	2	0	0	30	20	50			50	100	**0**
9		MOOCs (For B.Tech. Hons. Degree)											
		TOTAL										**900**	**20**

***Foreign Language:**

1. French
2. German
3. Japanese

*** List of MOOCs Based Recommended Courses for first year (Semester-I) B. Tech Students**

S. No.	Subject Code	Course Name	University / Industry Partner Name	No of Hours	Credits
1		Next Gen Technologies	Infosys Springboard	10h 14m	**0.5**
2		Programming Fundamentals using Python - Part 1	Infosys Springboard	43h 25m	**3.5**

Abbreviation Used:

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, PS: Practical Sessional, TE: Theory End Semester Exam., PE: Practical End Semester Exam.

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Bachelor of Technology
Mechanical Engineering

EVALUATION SCHEME

SEMESTER-II

S. No.	Subject code	Subject	Periods			Evaluation Schemes				End Semester		Total	Credit
			L	T	P	CT	TA	TOTAL	PS	TE	PE		
1		Engineering Mathematical-II	3	1	0	30	20	50		100		150	**4**
2		Engineering Physics	3	0	0	30	20	50		100		150	**3**
3		Emerging Trends in Mechanical Engineering	3	0	0	30	20	50		100		150	**3**
		Design Thinking-I	2	0	0	30	20	50		50		100	**2**
4		Advanced Python	0	0	6				50		100	150	**3**
5		Communication for Career Enhancement	0	0	4				50		50	100	**2**
6		Engineering Physics Lab	0	0	2				25		25	50	**1**
7		C Programming	0	0	6				50		100	150	**3**
8		Constitution of India, Law and Engineering/Essence of Indian Traditional Knowledge	2	0	0	30	20	50			50	100	**0**
9		MOOCs (For B.Tech. Hons. Degree)											
		TOTAL										1000	**21**

*** List of MOOCs Based Recommended Courses for first year (Semester-II) B. Tech Students**

S. No.	Subject Code	Course Name	University / Industry Partner Name	No of Hours	Credits
1		Design Thinking for innovation	Infosys Springboard	6 h	0.5
2		Programming In C	Infosys Springboard	17h 7 m	1

NOTE:

- **Internship (3-4 weeks) shall be conducted during summer break after II semester and will be assessed during III semester**

Abbreviation Used:

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, PS: Practical Sessional, TE: Theory End Semester Exam., PE: Practical End Semester Exam.

AICTE Guidelines in Model Curriculum:

A student will be eligible to get Under Graduate degree with Honors only, if he/she completes the additional MOOCs courses such as Coursera certifications, or any other online courses recommended by the Institute (Equivalent to 20 credits). During Complete B.Tech. Program Guidelines for credit calculations are as follows.

1. For 6 to 12 Hours =0.5 Credit
2. For 13 to18 =1 Credit
3. For 19 to 24 =1.5 Credit
4. For 25 to 30 =2 Credit
5. For 31 to 35 =2.5 Credit
6. For 36 to 41 =3 Credit
7. For 42 to 47 =3.5 Credit
8. For 48 and above =4 Credit

For registration to MOOCs Courses, the students shall follow Coursera registration details as per the assigned login and password by the Institute these courses may be cleared during the B. Tech degree program (as per the list provided). After successful completion of these MOOCs courses, the students shall provide their successful completion status/certificates to the Controller of Examination (COE) of the Institute through their coordinators/Mentors only.

The students shall be awarded Honors Degree as per following criterion.

i. If he / she secures 7.50 as above CGPA.
ii. Passed each subject of that degree program in the single attempt without any grace.
iii. Successful completion of MOOCs based 20 credits

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B. Tech. First Semester	**Branch: ME**	**Credit: 3**		
Subject Code:		**L**	**T**	**P**
		0	**0**	**6**
Subject Name: CAD and Digital Manufacturing		**No. of hours: 40**		

Course Objective:

The course aims are to provide students with comprehensive knowledge and practical skills in Computer-Aided Design (CAD) and its application in digital manufacturing. Students will gain understanding of CAD software fundamentals and its relevance in modern industrial processes. Through advanced techniques in modeling, simulation, and prototyping, they will learn to effectively design the products for digital fabrication methods like 3D printing and CNC machining. The course emphasizes hands-on learning with practical exercises and real-world case studies, enabling students to develop critical problem-solving abilities essential in the field of CAD and digital manufacturing.

Course outcome: At the end of course, the students will be able to

CO1	Understand the importance of engineering graphics.
CO2	Understanding dimensioning principles and applying them accurately to convey design specifications.
CO3	Develop models in 3-Dimensional spaces.
CO4	Understand the concept of digital manufacturing.
CO5	Apply the knowledge of digital manufacturing in industries.

Course Content

Unit-I	**Introduction to CAD**	**8 Hours**

Introduction to Engineering Drawings, Scale, Basic Measurement System, Coordinate System, Types of View: Orthographic, Isometric & Perspective, Type of Projection, Sections of solids and Development of surfaces, Introduction to CAD Software, Exploring GUI, Workspaces, Co-ordinate systems, File Management, Display Control.

Unit-II	**Working on CAD in 2D environment**	**8 Hours**

Starting with Sketching, Working with Drawing Aids, Editing Sketched Objects, Layers, Creating Text and Tables, Dimensioning and Detailing of Drawings, Editing Dimensions, Dimension Styles, Adding Constraints to Sketches, Hatching Drawings, Paper Layout, Plotting Drawings in AutoCAD, Template Drawings.

Unit-III	**Working on CAD in 3D environment**	**8 Hours**

Introduction to 3D Modeling, 3D Environment and Drawing, Modeling Workflow, Editing Models, Assembly, sectioning a Model and Creating Drawings, Visualization, Downstream, Rectangular 3D coordinates, 3D Construction techniques, constructing wireframe objects, constructing solid primitives, dynamically changing a 3D view, and shading a 3D model, Blueprint Drawing, Uses of Digital Prototype.

Unit-IV	**Introduction to Digital Manufacturing**	**8 Hours**

Introduction to workshop layout, engineering materials, Fitting, Carpentry, Forging, Casting, Welding, Forming, Basic Machining Tools: Lathe, Milling, Drilling, Shaper, Grinding, Introduction to Digital Manufacturing: additive manufacturing, basics of automation & robotics and Industry 5.0.

Unit-V	Applications of Digital Manufacturing	8 Hours

3D Modelling and simulation of various Forming, Machining in CAD, Overview of Computational Fluid Dynamics, Basic introduction to 3D Printing & Technologies (FDM, LDM, SLA) Slicing software. Types of Production, Various types of Industries, Introduction to Smart Factory.

Textbooks:

1. A Handbook on AUTOCAD tool practice by SSR Krishna
2. Engineering. Graphics, by Agrawal B. & Agrawal CM., TMH Publication
3. Engineering. Drawing by Bhatt ND, Charotar Publiction.
4. CAD by CAM by M.P. Grover.
5. A course in Workshop technology by B.S. Raghuwanshi, Vol I & II, Dhanpat Rai & sons, New Delhi
6. Industrial automation and Robotics by A.K. Gupta., S K Arora, Laxmi publication
7. CNC Fundamentals and Programming by P.M Agarwal, V.J Patel, Charotar Publication

Reference Books:

1. Engineering Drawing +AUTOCAD 6th Edition by K Venugopal & V Prabhu Raja, New Age International Publishers
2. Computer Aided Engineering Drawing - S. Triyambaka Murthy, - I.K. International Publishing House Pvt. Ltd., New Delhi.
3. Advance CAD Modelling by Nicola & Duhovnik
4. Manufacturing Engineering and Technology, Kalpakjian S. And Steven S. Schmid, 4th edition, Pearson Education India Edition.
5. Rapid Product Development, Kimura Fumihiko
6. CNC Machines by M. Adhitan, B.S Pabla; New age international.
7. CAD/CAM, by Groover and Zimmers, Prentice Hall India Ltd

Links:

1. AutoCAD Basics
2. AutoCAD 3D Screwdriver
3. AutoCAD 3D Funnel Model
4. AutoCAD 3D Wooden Table
5. AutoCAD 3D Door Model
6. AutoCAD 3D Window Model
7. AutoCAD 3D Spark Plug Model
8. AutoCAD 3D Jet Engine Propeller
9. AutoCAD 3D Wind Turbine Model
10. AutoCAD 3D Solar Panel Layout
11. AutoCAD 3D Belt Pulley Model
12. Fitting, fitting operations
13. Carpentry joints and operations
14. Forging operations
15. Casting Process
16. Forging operations such as drawing out, upsetting, bending, upsetting
17. To demonstrate casting experiments using materials like aluminum or bronze.
18. To study different welded joints using different welding techniques.

19. To study basic metal forming techniques (rolling, extrusion, wire drawing)
20. Study of Machining Tools- Lathe, Milling
21. Study of Machining Tools- Drilling, Shaper, Grinding.
22. Study and demonstration of automation & robotics.
23. To study the concepts of Industry 4.0 & Industry 5.0
24. Setting up of work piece zero position and tool adjustment in CNC Turning machine
25. To write and simulate CNC Part program
26. CNC Part program for facing operation
27. CNC Part program for milling operations.
28. FDM 3D Printing Technology.
29. SLA 3D Printing Technology.
30. conversion of CAD model on a slicing software.
31. AutoCAD Projects
32. AutoCAD 2D Drawings
33. AutoCAD 3D Drawings
34. CAD Projects

Lab No.	UNIT	Topic	Simulator / Software	CO Mapping
1	1	To create design of a robotic Arm model on CAD	AutoCAD	CO1
2		To draw & design a Cell phone adapter in CAD Software.	AutoCAD	CO1
3		To create layout of job shop, batch shop and continuous manufacturing on CAD	AutoCAD	CO1
4		To draw the orthographic projection view of Hub, Arms, and Face of a Pulley	AutoCAD	CO1
5		To draw the isometric projection view of Pipe, 90-degree elbow and 180-degree bend of a piping system	AutoCAD	CO1
6		To draw the isometric projection view of motor coupling in CAD Software	AutoCAD	CO1
7		To draw the orthographic projection view of a Study Chair.	AutoCAD	CO1
8		To draw the isometric projection view of one-way mobile connector	AutoCAD	CO1
9		Two dimensional drawings of Cam and Rocker Arm on AutoCAD.	AutoCAD	CO1
10		To create a design of a Soap Case on CAD software.	AutoCAD	CO1
11		To draw a two-way cable connector on CAD software.	AutoCAD	CO1
12		To draw orthographic projections of hexagonal bolt in CAD Software.	AutoCAD	CO1
13		Two dimensional drawings of washer on AutoCAD.	AutoCAD	CO1
14		Two dimensional drawings of Gaskets of a vacuum pump on AutoCAD.	AutoCAD	CO1
15		To create 2D Drawings of Ring and Pinion Gear in CAD Software.	AutoCAD	CO1
16		To draw and design a phone stand/tripod in CAD software	AutoCAD	CO1

17		To draw an orthographic projection view of Edge Flange in CAD Software	AutoCAD	CO1
18		To draw the orthographic projection view of Fork End of a Knuckle Shaft	AutoCAD	CO1
19		To draw an orthographic projection view of Roller Stud in CAD Software	AutoCAD	CO1
20	2	To design a quadcopter drone on CAD	AutoCAD	CO2
21		To design a digital camera on CAD	AutoCAD	CO2
22		To design the layout of intent device connector on CAD	AutoCAD	CO2
23		To model & design a motor coupling in CAD Software.	AutoCAD	CO2
24		To design a 3D Model of a one-way mobile connector.	AutoCAD	CO2
25		To create 2D drawings of Helical Gear in AutoCAD Software.	AutoCAD	CO2
26		To draw & design a socket welded produced elbow in CAD Software.	AutoCAD	CO2
27		To create 2D model of crane hook	AutoCAD	CO2
28		Two-dimensional drawing of seal cover on AutoCAD software.	AutoCAD	CO2
29		Two dimensional drawings of a Friction plate on AutoCAD.	AutoCAD	CO2
30		To create 2D drawing of a threaded rod using AutoCAD Software.	AutoCAD	CO2
31		Create 2D drawings of Cam and camshaft bearings in AutoCAD	AutoCAD	CO2
32		To design a socket weld cross fitting model in CAD Software.	AutoCAD	CO2
33		To draw orthographic view of engine cylinder head in CAD software	AutoCAD	CO2
34		To demonstrate & draw a threaded rod using AutoCAD Software.	AutoCAD	CO2
35		To design a wrench in AutoCAD Software.	AutoCAD	CO2
36		To design a wristwatch in AutoCAD Software.	AutoCAD	CO2
37		To design a slip-on flange in AutoCAD Software.	AutoCAD	CO2
38		To design a CAR Wheel in CAD Software.	AutoCAD	CO2
39		Modelling and designing of steering wheel of a car in CAD software	AutoCAD	CO2
40		To create drawings of a Connecting Rod and Gudgeon pin on CAD software.	AutoCAD	CO2
41		To demonstrate a Butt-weld Straight Pipe Tee fitting and design it in CAD Software.	AutoCAD	CO2
42		To create a 2D drawing of Cotter and Sleeve	AutoCAD	CO2
43		To create 2D drawing of Knuckle Pin, Taper Pin and Collar in CAD Software	AutoCAD	CO2
44		To design a digital X-ray Machine on CAD	AutoCAD	CO2
45		To design & assemble a 3D pipe routing in CAD Software.	AutoCAD	CO2
46		To design an electric motor on CAD	AutoCAD	CO2
47		To create design of a CNC Lathe on CAD	AutoCAD	CO2
48		To create design of a Shaper Machine on CAD	AutoCAD	CO2
49		To create design of a Milling Machine on CAD	AutoCAD	CO2
50		To create design of a drilling Machine on CAD	AutoCAD	CO2
51		To create design of carpentry joints on CAD	AutoCAD	CO2
52		To create 2D drawings of Cam and followers on CAD	AutoCAD	CO2
53		To create design of a 3D printer machine on CAD	AutoCAD	CO2

54		To create layout of workshop on CAD	AutoCAD	CO2
55		To design & assemble a 3d model of Cotter and Sleeve Joint with all dimensions and allowances	AutoCAD	CO3
56		To design & assemble a 3d model of knuckle joint with dimensions and allowances in CAD Software.	AutoCAD	CO3
57		To draw & model a spiral spring in AutoCAD Software.	AutoCAD	CO3
58		To design an edge flange on base flange using CAD Software.	AutoCAD	CO3
59		To model & design a Roller Stud in CAD Software.	AutoCAD	CO3
60		To model & design a Pulley used to transmit power.	AutoCAD	CO3
61		To model & design a 3D Model of a Study Chair in AutoCAD Software.	AutoCAD	CO3
62		To design the 3D assembly of Cam and Rocker Arm on AutoCAD.	AutoCAD	CO3
63		To create a 3D model of water bottle in CAD Software.	AutoCAD	CO3
64		To create the 3D drawing of Differential on AutoCAD.	AutoCAD	CO3
65		Modelling and designing of door lock handle in CAD software	AutoCAD	CO3
66		To design & model a chain ring in CAD Software.	AutoCAD	CO3
67		To create 3D model of crane hook	AutoCAD	CO3
68		Modelling and designing of a fry pan used in kitchen	AutoCAD	CO3
69		To draw and modelling of Camshaft assembly used in multicylinder engines.	AutoCAD	CO3
70		Modelling and designing of a rotor of turbine	AutoCAD	CO3
71	3	3D modelling of a kitchen sink in CAD Software.	AutoCAD	CO3
72		To create 3D design of Auto headlight reflector on AutoCAD software.	AutoCAD	CO3
73		To design a 3d design of water pump fan in CAD Software.	AutoCAD	CO3
74		To design a wristwatch in AutoCAD Software.	AutoCAD	CO3
75		Designing and modelling of wardrobe in CAD Software	AutoCAD	CO3
76		Modelling and designing of English toilet seat in CAD software	AutoCAD	CO3
77		Modelling and designing of steering wheel of a car in CAD software	AutoCAD	CO3
78		Modelling and designing of a computer mouse by mesh modelling in CAD software	AutoCAD	CO3
79		Modelling and designing of a chair wheel of revolving chair	AutoCAD	CO3
80		Modelling and designing of transition duct in CAD software	AutoCAD	CO3
81		Modelling and designing of exhaust manifold of engine	AutoCAD	CO3
82		To design a 3D Model of a bike suspension in CAD Software.	AutoCAD	CO3
83		To model & design of a Drone Fan in CAD Software.	AutoCAD	CO3
84		To demonstrate & design a Motorcycle front sprocket in CAD Software.	AutoCAD	CO3
85		To draw elevation and plan of a home on CAD.	AutoCAD	CO3
86		To draw elevation and plan of a town on CAD.	AutoCAD	CO3
87		To create an assembly of a Connecting Rod on CAD software.	AutoCAD	CO3
88		To design a water, tap in AutoCAD Software.	AutoCAD	CO3
89		To design a Footstep Power Generator in Designing Software.	AutoCAD	CO3

90		To create a Cam Follower assembly on CAD software.	AutoCAD	CO3
91		Introduction and demonstration of manufacturing processes- Fitting, Carpentry	Virtual Simulator	CO4
92		To simulate different fitting operations through simulation	Process Simulator	CO4
93		To Introduce students to basic wood carving techniques using carving chisels and gouges	Process Simulator	CO4
94		To practice carving simple designs or patterns on wooden blocks.	Process Simulator	CO4
95		Introduction and demonstration of manufacturing Processes- Forging, Casting	Virtual Simulator	CO4
96		To teach students basic hammering techniques used in forging, such as drawing out, upsetting, bending.	Process Simulator	CO4
97		Demonstrate the process of punching holes or slots in a forged work piece using a punch and drift	Process Simulator	CO4
98		To simulate forging process like punching, upsetting using process simulator	Process Simulator	CO4
99		To perform casting experiments using materials like aluminium or bronze.	Process Simulator	CO4
100		To investigate the effect of mold temperature on cast parts.	Process Simulator	CO4
101	4	To investigate the effect of pouring temperature on cast parts	Process Simulator	CO4
102		To investigate the effect of cooling rate on cast parts	Process Simulator	CO4
103		Introduction and demonstration of manufacturing Processes- Welding, Forming.	Virtual Simulator	CO4
104		To study different welded joints using different welding techniques.	Virtual Simulator	CO4
105		To simulate Electric arc welding through different welding techniques	Process Simulator	CO4
106		To simulate MIG welding with the help of the processes simulator	Process Simulator	CO4
107		To simulate TIG welding with the help of the processes simulator	Process Simulator	CO4
108		To study basic metal forming techniques (rolling, extrusion, wire drawing)	Virtual Simulator	CO4
109		To simulate rolling process using virtual simulator	Virtual Simulator	CO4
110		To simulate extrusion process using virtual simulator	Virtual Simulator	CO4
111		To simulate wire drawing process using virtual simulator	Virtual Simulator	CO4

112		Study of Machining Tools- Lathe, Milling	Virtual Simulator	CO4
113		Study of Machining Tools- Drilling, Shaper, Grinding	Virtual Simulator	CO4
114		To simulate lathe machine to obtain desired shape and size.	Process Simulator	CO4
115		To simulate drill machine to obtain holes of different diameter.	Process Simulator	CO4
116		To simulate lathe machine to obtain desired shape and size.	Process Simulator	CO4
117		Study and demonstration of automation & robotics	Construction Equipment	CO4
118		To study the concepts of Industry 4.0	Simulator	CO4
119	5	3D Modelling and simulation of Machining in CAD	Construction Equipment Simulator	CO5
120		3D Modelling and simulation of sheet bending in CAD	Construction Equipment Simulator	CO5
121		Setting up of work piece zero position and tool adjustment in CNC Turning machine	Process Simulator	CO5
122		To write and simulate CNC Part program for turning operation as per drawing	Control System Simulator	CO5
123		To write and simulate CNC Part program for facing operation as per drawing	Control System Simulator	CO5
124		To write and simulate CNC Part program for drilling operation as per drawing	Control System Simulator	CO5
125		To write and simulate CNC Part program for milling operations.	Control System Simulator	CO5
126		Study of FDM 3D Printing Technology.	Process Simulator	CO5
127		Study of LDM 3D Printing Technology.	Process Simulator	CO5
128		Study of SLA 3D Printing Technology.	Process Simulator	CO5

129		Visualization and conversion of CAD model on a slicing software.	Process Simulator	CO5
130		Create a product using a 3D printer machine tool through different 3D printing techniques	Robotics Simulator	CO5
131		Study of different type of production systems used in industry- Job, Batch, Mass, Continuous (Case Studies and Examples)	Process Simulator	CO5
132		Study of different types of industries (Case Studies and Examples)	Process Simulator	CO5
133		Design and implementation of Smart factory for Industry Revolution 4.0	Robotics Simulator	CO5
134		To create digital twins of given parts using smart manufacturing simulation software	Smart manufacturing simulator	CO5
135		Objective is to familiarize students with the operation of CNC machines, including their components, controls, and functionalities. Through hands-on experiments, students gain practical knowledge of setting up work pieces, tooling, and executing machining operations.	Robotics Simulator	CO5
136		Objective is to enhance students' programming skills for CNC machines. By designing and executing different machining operations, students learn to write and debug CNC programs, understand G-code instructions, and create efficient tool paths.	Robotics Simulator	CO5
137		Objective is to teach students how to optimize machining processes using CNC machines. Through experiments, students learn to analyse different parameters such as cutting speed, feed rate, and tool path strategies to achieve desired machining results, including surface finish, accuracy, and cycle time reduction	Robotics Simulator	CO5
138		Objective is to expose students to advanced CNC techniques and capabilities. Through experiments, students can explore topics such as multi-axis machining, high-speed machining, tool change management, and complex part production to expand their knowledge and skills in CNC machining.	Robotics Simulator	CO5
139		Objective is to help students understand the impact of machining variables on the quality of machined parts. Through experiments, students can explore variables like tool geometry, tool material, cutting parameters, and machining strategies to analyse their effects on surface finish, dimensional accuracy, and tool life.	Robotics Simulator	CO5
140		Objective is to teach students how to use simulation and verification tools to validate and optimize CNC programs before executing them on the machine. Through experiments, students can understand the importance of simulation in preventing collisions, verifying tool paths, and optimizing machining processes.	Robotics Simulator	CO5

141		Objective is to develop students' problem-solving and troubleshooting skills in CNC machining. Through experiments, students encounter and resolve issues such as tool breakage, incorrect tool paths, or machine errors, helping them develop critical thinking and decision-making abilities.	Robotics Simulator	CO5
142	1	1.1 Introduction to basic electronic components like capacitors, resistors, LEDs, transistors, diodes, etc. 1.2 Describe and demonstrate the hands-on use of a multi-meter to check component and circuit status. 1.3 Introduction to the Soldering Procedure along with hands-on practice.	IDEA Lab	CO5
143	2	2.1 Design and implement the connection of a LED with a battery via Tinkercad and using hardware. 2.2 Design and implement the connection of a Buzzer with a battery via Tinkercad and using hardware. 2.3 Design and implement the connection of a DC motor with a battery via Tinkercad and using hardware. 2.4 Design and implement the connection of a potentiometer with an LED and a battery via Tinkercad and using hardware.	IDEA Lab	CO5
144	3	3.1 Design and implement the connection of a potentiometer with a DC motor and a battery via Tinkercad and using hardware. 3.2 Design and implement the connection of a push button with an LED and a battery via Tinkercad and using hardware.	IDEA Lab	CO5
145	4	4.1 Introduction and demonstration of 3D printing 4.2 Introduction and demonstration of 3D Scanning	IDEA Lab	CO5
146	5	Design and implement the project of a traffic light via Tinkercad and using hardware.	IDEA Lab	CO5
147	6	6.1 Introduction to Arduino Boards. 6.2 Hands-on session on Arduino IDE basic components for automation.	IDEA Lab	CO5
148	7	Design and implement the project of Basic Home Automation via Tinkercad and using hardware.	IDEA Lab	CO5
149	8	Understanding the working of MV Laser and performing engraving, cutting operation.	IDEA Lab	CO5
150	9	Understanding the working of CNC Router Machine and performing engraving using CNC Router.	IDEA Lab	CO5
151	10	Hands-on- training on different tools and making enclosure and support for the project.	IDEA Lab	CO5
Projects	1	**Home Automation using Voice Assistant (Alexa/Google Home):** In this project you will learn how you can control a lamp, fan, curtain or any other electrical appliance in your space using an Arduino. At	IDEA Lab	CO5

		the end of the project, you will be able to control the connected load from your smartphone**.**		
	2	**Line Follower Robot:** The concept of the line follower robot is related to light. Here, we use the behaviour of light on the black-and-white surface. The white colour reflects all the light that falls on it, whereas the black colour absorbs the light. In this line-follower robot, we use IR transmitters and receivers (photodiodes).	IDEA Lab	CO5
	3	**Obstacle Avoider Robot:** An obstacle avoiding robot is a fully autonomous robot which can be able to avoid any obstacle which it faces when it moves. Simply, when it met an obstacle while it is moving forward, automatically stops moving forward and makes a step back.	IDEA Lab	CO5
	4	**Office Desk Decore displaying Time Temperature and Humidity:** This project aims to display the time, temperature and humidity using the DHT11 sensor and LCD display 1602 with an I2C module.	IDEA Lab	CO5
	5	**Num pad-based door lock:** In this project, you can design an Arduino Keypad Door Lock which can be mounted to any of your existing doors to secure them with a digital password.	IDEA Lab	CO5
	6	**Traffic Light Simulation:** We will use three LEDs in this project to simulate the sequence of traffic lights (red, yellow and green). By starting with this project, we will be able to learn to control light sequentially and with different timing.	IDEA Lab	CO5
	7	**Smoke Detecting IoT Device Using Gas Sensor:** Smoke Detecting IoT device is a smart fire detection system that can detect combustible gases and alert you to act immediately to control or stop the fire from breaking out. With the help of Arduino, an MQ-2 Smoke detection sensor, a breadboard, some jumper wires, a resistor, two LEDs, and a buzzer, one can quickly build this fire detection system using IoT.	IDEA Lab	CO5
	8	**Tank Water Monitoring System:** This device applies the power of the internet of things to build a water monitoring system to reduce water wastage. It notifies you when the water reaches the maximum or the minimum level. The primary components used in this project are Arduino UNO, Ultrasonic sensor, Buzzer, and Bolt Wi-Fi module.	IDEA Lab	CO5
	9	**Gesture-Controlled Contactless Switch:** This IoT project aims to build a gesture-controlled switch that you can use in homes and public places to control all kinds of connected devices on an IoT network. Here are the components you need for the project, Arduino mini pro, OLED Display, Channel Relay, 5V adaptor, Gesture Sensor, and a bulb.	IDEA Lab	CO5
	10	**Distance Measurement Using Ultrasonic Sensor:** The main part of this project is the ultrasonic sensor. We will be able to measure distances at high accuracy using sound waves.	IDEA Lab	CO5

	11	**Temperature and Humidity Monitor:** With this project we can gain more knowledge how to connect humidity and temperature sensors to accurately monitor the environment.	IDEA Lab	CO5
	12	**To control the speed of a railway barrier using servo motor:** This project introduces us to servo motors which is a fascinating motor that transforms electrical signal into accurate mechanical motion.	IDEA Lab	CO5
	13	**To design on screen information LCD display:** In this project we will be able to learn how to interface an LCD with arduino and create an on-screen information system.	IDEA Lab	CO5
	14	**To design a security-based alarm system using PIR based sensor:** This project helps us to develop a system that detects motion and sound. This arduino based alarm system combines a PIR motion sensor and a buzzer.	IDEA Lab	CO5
	15	**To design a visual display of multiple patterns using 8x8 LED matrix with arduino circuit:** LED matrices are very captivating, it creates a visual display, multiple patterns and simple animations	IDEA Lab	CO5
	16	**To design an anti-theft alarm system using force sensor:** With this project we create a basic but effective security solution that can be used to protect valuables or any entry points in a place.	IDEA Lab	CO5
	17	**To design a security system using RFID based access control:** This project has the power of RFID and arduino which provides us an advanced and futuristic way to manage access and increase security.	IDEA Lab	CO5
	18	**To design a fluid flow rate and volume monitoring system:** This project guides us through interfacing a flow sensor with arduino to measure the rate at which the water flows through a pipe and also calculate the total volume passed.	IDEA Lab	CO5

Noida Institute of Engineering and Technology
Greater Noida
(An Autonomous Institute)

B. Tech. Second Semester	**Branch: ME**	**Credit: 3**		
Subject Code:		**L**	**T**	**P**
		3	**0**	**0**
Subject Name: Emerging Trends in Mechanical Engineering		**No. of hours: 40**		

Course Objective:

This course aims to introduce first-year students to the latest developments in the field of Mechanical Engineering, covering product design, prototyping, manufacturing, and emerging sectors such as 3D printing and robotics. Students will gain thorough insight over prototyping techniques, learn design trade-offs and understand the concepts of Industry 4.0 and 5.0. The course prepares students to navigate the evolving landscape of mechanical engineering and contribute to innovative solutions.

Course outcome: At the end of course, the students will be able to

CO1	Understand the concepts of mechanical engineering, product design, prototyping and manufacturing processes.	K_2
CO2	Gain knowledge about emerging sectors in mechanical engineering and their applications.	K_2
CO3	Be familiar with various prototyping techniques and their use in mechanical engineering projects.	K_2
CO4	Understand the concept of design tradeoffs in mechanical engineering projects.	K_2
CO5	Understand the concepts of Industry 4.0 and Industry 5.0 and their applications in various engineering domains.	K_2

Course Content

Unit-I	**Introduction to Mechanical Engineering and Product Manufacturing**	**8 Hours**

Overview of Mechanical Engineering: Role of mechanical engineers, tools in ME, skills and abilities, ethics in engineering.

Traditional and emerging sectors in mechanical engineering: Competencies required for traditional and emerging sectors, Major employers in each sector for freshers. History of machines and mechanisms.

Introduction to product concept, design, and prototyping: Product concept: shape, size, design and contour**,** Product Lifecycle Management.

Product engineering and manufacturing processes: Process selection and tooling**,** Production, productivity and quality control**,** Product centering, quality, and reliability**,** Planning and supply chain management**,** Material, and part selection.

Unit-II	**Emerging Sectors in Mechanical Engineering**	**8 Hours**

3D Printing: Creation of custom parts and components**,** Custom prosthetics, Implants, Medical devices

Electric Vehicles: The future of automobiles, batteries, electric motors, power electronics, and charging infrastructure.

Robotics and Automation: Sensors, Actuators, use in Welding, Machining, Assembling

Internet of Things (IoT) and IIoT: To create connected products, monitor, control and automate processes, machine-to-machine communication.

Artificial Intelligence: Makes Machines Smarter, use in Mechanical processes, Analyse data, Decisions making, autonomous vehicles, robots,

Sustainable Design: Tackles Climate Change, use in solar panels, wind turbine.

Digital Twins and CAD Evolution: Digital-physical fusion, use to simulate, predict, and optimize a product and its production system.

Unit-III	Prototyping	8 Hours

Introduction to prototyping techniques: Importance of prototyping in mechanical engineering

Types of prototyping: Rapid (Throwaway) prototyping, Evolutionary prototyping, Incremental prototyping, Extreme prototyping.

Prototyping techniques: 3D printing for prototyping, Hand sketching and model making, CNC machining for prototyping, Other prototyping methods.

Prototyping tools and software: Overview of prototyping tools and software, Selection of appropriate tools and software.

Testing and validation of prototypes: Importance of prototype testing and validation, Techniques for testing and validating prototypes.

Unit-IV	Design Tradeoffs	8 Hours

Introduction to Design Tradeoffs: Definition, Importance, customer requirements and segmentation. Design for X, Design for Manufacturing, Design for Assembly, Design for cost, Design for Safety and Reliability, Design for Maintenance & Serviceability, Design for Testing, Design for safe disposal and Recycling.

Ethical Considerations in Design Tradeoffs: Professional Responsibility, Legal Consideration, and Social & Environmental Impact.

Unit-V	Industry 5.0 and Applications	8 Hours

Industrial Revolution.

Overview of Industry 4.0: Mass customization and intelligent supply chain systems**,** Key technologies, and principles of Industry 4.0

Introduction to Industry 5.0: Hyper-customization and responsive supply chain systems**,** Smart products, and human-centric industry

Applications of new technologies in various engineering domains: Aerospace, aviation, defense, marine, nuclear, agriculture.

Future trends and challenges in Industry 5.0: Potential impact of Industry 5.0 on mechanical engineering, Challenges, and opportunities for future professionals.

Textbooks:

1. Emerging Trends in Mechanical Engineering: Dinesh V. Lohar, Ganesh J. Pagar, Shailesh S. Parkhe, Alkesh S. Ajamere , N.S. Salunke
2. Emerging Trends in Mechanical Engineering: L. M. Das, Naveen Kumar, Rohit Singh Lather, Pramod Bhatia
3. Advanced Research And Real-World Applications of Industry 5.0 : Elspeth McKay , Mahmoud Numan Bakkar
4. Engineering Design: A Project-Based Introduction by Clive L. Dym, Patrick Little, Elizabeth J. Orwin, and Richard T. Spjut
5. Rapid Prototyping: Theory and Practice edited by Ali K. Kamrani and Emad Abouel Nasr
6. Prototyping for Mechanical and Aerospace Design by Haitham Hassan
7. Electric and Hybrid Vehicles: Design Fundamentals by Iqbal Husain
8. Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing by Ian Gibson, David W. Rosen, and Brent Stucker

Reference Books:

1. Automation, Productions systems, Computer Integrated Manufacturing: Mikell P. Groover by Pearson

2. Publication
3. Rapid Product Development, Kimura Fumihiko
4. Mechatronics: William Bolton
5. Industrial automation and Robotics by A.K. Gupta., S K Arora, Laxmi publication
6. CNC Fundamentals and Programming by P.M Agarwal, V.J Patel, Charotar Publication
7. Mechanical Design Process by David G. Ullman
8. Product Design and Development by Karl T. Ulrich and Steven D. Eppinger
9. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing by Ian Gibson, David W. Rosen, and Brent Stucker
10. Electric Vehicle Technology Explained by James Larminie and John Lowry
11. The 3D Printing Handbook: Technologies, Design and Applications" by Ben Redwood, Filemon Schöffer, and Brian Garret

You Tube & NPTEL Video Links:

Unit 1

1. Product Design & Development: https://youtu.be/djB9oK6pkbA?si=b_1sqHAzXKxYIEVb
2. Skills: https://youtu.be/xRd2KG3B5V4?si=Lwp6FbYlh3LQDdw
3. Machine & Mechanism: https://www.youtube.com/@machinethinking
4. NPTEL: https://www.youtube.com/watch?v=9WPZStQp03Q
   https://archive.nptel.ac.in/courses/112/107/112107217/

Unit-2

1. Electric Vehicles: https://youtu.be/Iyp_X3mwE1w?si=ymFDmceJDAU4vNq3
2. 3d Printing: https://youtu.be/2vFdwz4U1VQ?si=TW6Vd6sy-loXz8C0
3. IOT: https://youtu.be/h0gWfVCSGQQ?si=hWC8733S_tWcIN-g
4. Digital Twin: https://youtu.be/Bgs_Z0peXmc?si=7JYG9DSvuvZsEkOU
5. NPTEL: https://archive.nptel.ac.in/courses/112/103/112103306/
   https://archive.nptel.ac.in/courses/108/102/108102121/
   https://archive.nptel.ac.in/courses/107/106/107106090/
   https://archive.nptel.ac.in/courses/106/105/106105166/
   https://nptel.ac.in/courses/106105077

Unit-3

1. Rapid Prototyping 1: https://youtu.be/Fi7RXDUuX7I?si=ukQCaKz8ieE5_UvE
2. Rapid Prototyping 2: https://youtu.be/6W0sH1JZiaY?si=EIAXwcpH0Er2Og9q
3. NPTEL: http://ndl.iitkgp.ac.in/he_document/nptel/nptel/courses_112_104_112104230_video_lec35
   https://archive.nptel.ac.in/courses/112/104/112104265/

Unit-4

1. Design Tradeoff: https://youtu.be/g5QON5P7jzk?si=mC3ZVNXpwYhD57zW
2. NPTEL: https://archive.nptel.ac.in/courses/112/107/112107258/
   https://valliammai.digimat.in/nptel/courses/video/112107217/L14.html

Unit 5

1. Industry 4.0: https://youtu.be/OLz2foqM5r0?si=ldwzjd00oob13M3k
2. Industry 5.0: https://youtu.be/ODFA8S8CmnU?si=indxB8xTIp3-o8yL
3. NPTEL: https://archive.nptel.ac.in/courses/106/105/106105195/
   https://www.youtube.com/watch?v=h99AWCNGgdY