



SYLLABUS & CURRICULUM

DIPLOMA IN PLASTIC MOULD TECHNOLOGY (DPMT)

Implemented from Academic Year: 2023-24

Academic Cell

Central Institute of Petrochemicals Engineering & Technology (CIPET)

(Department of Chemicals & Petrochemicals,
Ministry of Chemicals & Fertilizers, Govt. of India)

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DIPLOMA IN PLASTICS MOULD TECHNOLOGY (DPMT)

VISION:

To enrich professionals with knowledge, skill and attitude for the manufacturing of quality moulds for plastic products.

MISSION:

- To develop high level competency in design, manufacturing and inspection of the Moulds, Dies and Tools.
- To train the students with state-of-the-art advanced machining techniques using CAD/CAM/CAE software for mould development.
- To impart the students with technical skills through hands-on practical training, industrial visits and computer-based simulation.
- To establish effective interaction with Industry, Institutions / Organizations.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO-01: Provide competency to the students to identify the machining process, plan tooling, design & development of the mould and dies.

PEO-02: Professionally develop the students to perform operations on machines including computer-based automated machines for manufacturing mould elements.

PEO-03: To inculcate students with leadership skills with high level of integrity and ethical values for team building and team work.

PEO-04: To motivate student to upgrade their technical skill and knowledge through lifelong learning.

PROGRAMME OUTCOMES (POs)

Basic and Discipline Specific Knowledge: Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.

Problem Analysis: Identify and analyse well-defined engineering problems using codified standard methods.

Design/ Development of Solutions: Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.

Engineering Tools, Experimentation and Testing: Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.

Engineering Practices for Society, Sustainability and Environment: Apply appropriate technology in context of society, sustainability, environment and ethical practices.

Project Management: Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.

Life-long Learning: Ability to analyse individual needs and engage in updating in the context of technological changes.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1:The capacity to interpret the theory of Plastic Mould Design & Manufacturing using the latest tools to make mould elements in compliance with relevant specifications.

PSO2:The capacity to identify and resolve the problems in the area of Manufacturing of Plastic Moulds & Dies.

Syllabus Structure at a Glance

Semester	Total Theory + Practical	Type of Courses	Hours	Credits	Total Marks		
			L+T+P		Theory	Practical	Total
1	5+ 3= 8	Humanities & Social Science + Basic Science Courses + Engineering Science Course + One Audit Course (Environmental Science)	540	22	500	300	800
2	5+ 3= 8	Humanities & Social Science + Basic Science Courses + Engineering Science Course	540	22	500	300	800
3	5+ 3= 8	Program Core Courses + One Engineering Science Course	540	22	500	300	800
4	5+ 4= 9	Program Core Courses + One Program Elective Course + One Engineering Science Course	540	22	500	300	800
5	5+ 4= 9	Program Core Courses + One Program Elective Course + One Open Elective Course + One Engineering Science Course	540	22	500	300	800
6	Project Work & In-plant Training in Industry	Project Work & In-plant Training in Industry	540	07	-	700	800
	Online Certification Course	One Online Certification Course of CIPET or NPTEL	Min. 30	03	100	-	
	Audit Course	Indian Constitution	2 Hour / Week	-	-	-	
Total				120	2600	2200	4800

DIPLOMA IN PLASTICS MOULD TECHNOLOGY (DPMT)

SEMESTER-I										
Course Code	Subject	Core (C) /Elective (E)	Hours Per Week			Total Hours	Credits	Marks		
			L	T	P			INT	EXT	TOTAL
Theory										
MMT 101	Communication English-I	C	2	1	-	54	03	40	60	100
MMT 102	Workshop Mathematics	C	2	1	-	54	03	40	60	100
MMT 103	Engineering Physics	C	2	1	-	54	03	40	60	100
MMT 104	Electrical & Electronics Engineering	C	2	1	-	54	03	40	60	100
MMT 105	Environmental Sciences	C	2	1	-	54	03	40	60	100
(18Weeks – 15HoursaWeek) Total (A)						270	15	200	300	500
Practical										
MMTL 101	Engineering Physics Lab	C	-	-	3	54	1.5	50	50	100
MMTL 102	Electrical & Electronics Engineering Lab	C	-	-	3	54	1.5	50	50	100
MMTL 103	Workshop Practice	C	-	-	8	144	04	50	50	100
	Library	-	1			18	-	-	-	-
(18Weeks – 15Hours a Week) Total (B)						270	07	150	150	300
(18Weeks – 30 Hours a Week) Total (A+B)						540	22	350	450	800

SEMESTER-II										
Course Code	Subject	Core (C) /Elective (E)	Hours Per Week			Total Hours	Credits	Marks		
			L	T	P			INT	EXT	TOTAL
Theory										
MMT 201	Communication English-II	C	2	1	-	54	03	40	60	100
MMT 202	Engineering Mathematics	C	2	1	-	54	03	40	60	100
MMT 203	Engineering Chemistry	C	2	1	-	54	03	40	60	100
MMT 204	Computer & Information Technology	C	2	1	-	54	03	40	60	100
MMT 205	Development of Life Skills	C	2	1	-	54	03	40	60	100
(18Weeks – 15HoursaWeek) Total (A)						270	15	200	300	500
Practical										
MMTL 201	Engineering Chemistry Lab	C	-	-	3	54	1.5	50	50	100
MMTL 202	Communication Lab	C	-	-	8	144	04	50	50	100
MMTL 203	Computer Engineering Lab	C	-	-	3	54	1.5	50	50	100
	Library	-	1			18	-	-	-	-
(18Weeks – 15Hours a Week) Total (B)						270	07	150	150	300
(18Weeks – 30 Hours a Week) Total (A+B)						540	22	350	450	800

SEMESTER – III										
Course Code	Subject	Core (C) /Elective (E)	Hours Per Week			Total Hours	Credits	Marks		
			L	T	P			INT	EXT	TOTAL
Theory										
MMT 301	Applied Mechanics & Strength of Material	C	2	1	-	54	03	40	60	100
MMT 302	Engineering Metrology	C	2	1	-	54	03	40	60	100
MMT 303	Machine Shop Technology-I	C	2	1	-	54	03	40	60	100
MMT 304	Engineering Drawing	C	2	1	-	54	03	40	60	100
MMT 305	Plastic Materials& Testing	C	2	1	-	54	03	40	60	100
(18Weeks – 15HoursaWeek) Total (A)						270	15	200	300	500
Practical										
MMTL 301	Machine Shop Practice-I	C	-	-	8	144	04	50	50	100
MMTL 302	Engineering Drawing Lab	C	-	-	3	54	1.5	50	50	100
MMTL 303	Plastics Testing Lab	C	-	-	3	54	1.5	50	50	100
	Library	-	1			18	-	-	-	-
(18Weeks – 15Hours a Week) Total (B)						270	07	150	150	300
(18Weeks – 30 Hours a Week) Total (A+B)						540	22	350	450	800

SEMESTER – IV										
Course Code	Subject	Core (C) /Elective (E)	Hours Per Week			Total Hours	Credits	Marks		
			L	T	P			INT	EXT	TOTAL
Theory										
MMT 401	Engineering Materials & Heat Treatment	C	2	1	-	54	03	40	60	100
MMT 402	Plastics Product &Mould Design	C	2	1	-	54	03	40	60	100
MMT 403	Machine Shop Technology-II	C	2	1	-	54	03	40	60	100
MMT 404	Plastics Processing Techniques	C	2	1	-	54	03	40	60	100
Elective 1*										
MMT405 Or MMT 405 or MMT 405	Industrial Management	E1	2	1	-	54	03	40	60	100
	Design of Jigs, Fixtures & Gauges									
	Hydraulics & Pneumatics									
(18Weeks – 15Hours a Week) Total (A)						270	15	200	300	500
Practical										
MMTL 401	Machine Shop Practice-II	C	-	-	8	144	3	50	50	100
MMTL 402	Plastics Processing Lab	C	-	-	3	54	1	25	25	50
MMTL 403	CAD Lab – I	C	-	-	3	54	1	25	25	50
MMTL 404	Student Club Activities	-	Beyond Lecture / Tutorial Hours				2	-	100	100
	Library	-	1			18	-	-	-	-
(18Weeks – 15Hours a Week) Total (B)						270	07	100	200	300
(18Weeks – 30 Hours a Week) Total (A+B)						540	22	300	500	800

SEMESTER – V										
Course Code	Subject	Core (C) / Elective (E)	Hours Per Week			Total Hours	Credits	Marks		
			L	T	P			INT	EXT	TOTAL
Theory										
MMT 501	CNC Machining Techniques	C	2	1	-	54	03	40	60	100
MMT 502	Mould Manufacturing Technology	C	2	1	-	54	03	40	60	100
MMT 503	Process Planning & Cost Estimation	C	2	1	-	54	03	40	60	100
Elective2*										
MMT 504	Additive Manufacturing Processes	E2	2	1	-	54	03	40	60	100
MMT 504	Computer Aided Manufacturing									
MMT 504	Industrial Automation & Mechatronics									
Elective 3* (Open Elective)										
MMT 505	Artificial Intelligence & Machine Learning	E3	2	1	-	54	03	40	60	100
MMT 506	Project Management									
MMT 507	Internet of Things									
(18Weeks – 15HoursaWeek)Total (A)						270	15	200	300	500
Practical										
MMTL 501	Mould Manufacturing Practice	C	-	-	8	144	03	50	50	100
MMTL 502	CAM & CNC Lab	C	-	-	3	54	01	25	25	50
MMTL 503	CAD Lab-II	C	-	-	3	54	01	25	25	50
MMTL 504	Report on Industry Visits		Beyond Lecture / Tutorial Hours / Weekends				02	-	100	100
	Library	-	1			18	-	-	-	-
(18Weeks – 15Hours a Week)Total (B)						270	07	100	200	300
(18Weeks – 30 Hours a Week)Total (A+B)						540	22	300	500	800

SEMESTER–VI										
Course Code	Subject	Core (C) / Elective (E)	Hours Per Week			Total Hours	Credits	Marks		
			L	T	P			INT	EXT	TOTAL
MMTP 601	Project Work & In-plant Training in Industry 18 Weeks / 30 Hours per Week	C	-	-	30	540	07	300	400	700
MMTP 602	Online Certification Course of CIPET / NPTEL	C	-	-	-	Min. 30	03	-	100	100
MMTP 603	Indian Constitution	Audit Course	2	-	-	--	-			
Total							10		800	

*Choose any one subject

L–Lecture

T–Tutorial

P–Practical

SEMESTER - I

Course Type	Course Code	Name of Course	L	T	P	Credit
Core	MMT101	Communication English-I	43	11	-	03

Course Objective

This course develops a level of proficiency for independent and effective communication for academic, professional and social requirements, writing structured and grammatical acceptable sentences and improves their listening, speaking and reading skills.

Learning Outcomes

- To enable the students to write structured and grammatical acceptable sentences.
- To improve their listening, speaking and reading skills.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Understanding of Parts of Speech, Tenses.	14	<ul style="list-style-type: none">• Formation of sentences.• Identify grammatical rules to form correct sentences.• Use correct sentence pattern in writing and speaking.• Enrich vocabulary.• State and identify various tenses to be used in a situation.
2.	Understanding of Visual Charts and Read and Interpret Information Correctly.	13	<ul style="list-style-type: none">• Types of visual communication• Build a presence with visual communication• Conciseness• Clarity• Tone• Active voice• Grammar & Punctuation
3.	Write and read essay and letters for communication purpose	13	<ul style="list-style-type: none">• Rules for writing Essay, Letters and practice of the same
4.	Answering verbal questions, dialogues writing and note making	14	<ul style="list-style-type: none">• Enhancing the answering skills for any verbal conversations during Interviews, technical paragraph.• Descriptive• Narrative• Greetings• Development of dialogue• Closing sentence
Total No. of Hours		54	

Text Books:

- Viswamohan, Aysha, “English for Technical Communication” Tata McGraw–Hill,2008.
- Regional Institute of English “English for Engineers”, Cambridge University Press, 2006.

Reference Books:

- A.S. Hornby, “The Advanced Learners Dictionary of Current English” Oxford University Press, 2004.
- Wren and Martin, “High School English Grammar and Composition”, S. Chand & co. Ltd. 2009.
- Glennis Pye, “Vocabulary in Practice – Part 1 to 4”, Cambridge University Press, 2004.
- Raymond Murphy, “Essential English Grammar”, Cambridge University Press, 1990.

Course Outcomes:

Upon Completion of this course the students will be able to

- Understand basic grammar principles.
- Write effective letters for seeking employment and complaints.
- Prepare technical reports, graphs and develop reading comprehension.
- Successfully participate in informal conversation & develops of skills to enable them to communicate themselves in their profession.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	3	2	2	1	1	2	3	2
CO2	3	3	2	2	1	1	2	3	2
CO3	3	3	2	2	1	1	2	3	2
CO4	3	3	2	2	1	1	2	3	2

Course Type	Course Code	Name of Course	L	T	P	Credit
Core	MMT 102	Workshop Mathematics	43	11	-	03

Course Objective

To impart Mathematical concepts applied for day-to-day workshop/ shop floor activities in industry.

Learning Outcomes

Able to apply Mathematical relations for the solutions of workshop/ shop floor of Industry.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Elementary Mathematics	13	<ul style="list-style-type: none"> Understanding simple fraction, addition, subtraction, multiplication, percentage and quadratic equation
2	Trigonometry	14	<ul style="list-style-type: none"> Can use Trigonometric ratio and its table. Sine & cosine rule, Solutions of triangle, compound angles and multiple angles – able to solve simple problems. Find unknown angles in any triangles, trigonometric ratios of multiple angles (2A & 3A) and problem solving the expansions
3.	Binomial Theorem and Pair of Straight Lines	13	<ul style="list-style-type: none"> Statement & Simple Problems of Binomial Theorem, General & Middle Terms of Binomial Expansion. Understand pair of line passes through organizing second degree equations – simple problems.
4.	Circles and Mensuration	14	<ul style="list-style-type: none"> Illustrate and name the parts of a circle, radius, diameter & circumference and using General equations of a Circle able to find center, radius and equation of the circle. Area and Circumference of 2D shapes with simple problems. Surface Areas & Volume of 3D shapes
Total No. of Hours		54	

Text Books:

- B R Das, "ITI Workshop Calculations" Neelkanth Publication, 2008
- W A J Chapman, "Applied workshop calculations" Hodder & Stoughton Educational; 3rd Revised edition, 1965

Reference Book:

- F J Camm, "Workshop Calculations Tables & Formulae", Newnes, 1952.
- W AJ Chapman, "Senior Workshop Calculation" Bharath-A28KED5E1JUIJA, 1975.
- F.J. McMackin, "Mathematics of the shop" Delmar Publishing Co, U.S.; 3rd Revised Edition, 1968

Course Outcomes:

Upon Completion of this course the students will be able to

- Solve simple fraction and quadratic equations.
- Apply the binomial theorem.
- Derive the equation of a line and circle (in different form).
- Apply the value of trigonometric ratios and solve the problem related to standard angles, compound and multiple angles.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	3	2	2	1	1	2	3	2
CO2	3	3	2	2	1	1	2	3	2
CO3	3	3	2	2	1	1	2	3	2
CO4	3	3	2	2	1	1	2	3	2

Course Type	Course Code	Name of Course	L	T	P	Credit
Core	MMT 103	Engineering Physics	43	11	-	03

Course Objective

In this course students will be able to develop fundamental knowledge and its applications relevant to various streams, units and derivations, knowledge on vector and scalar quantities, basic applications of optics and Laser etc.

Learning Outcomes

- To introduce the basic concepts of units and derivations, knowledge on vector and scalar quantities.
- To understand the basic applications of optics and Laser.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Units & Dimensions and Vectors	14	<ul style="list-style-type: none"> • Understand different systems of units & dimensions, dimensional formulae and derivation of expression of period of simple pendulum. • Knowledge on scalar & vector quantities.
2.	Forces & Motion and Elasticity	13	<ul style="list-style-type: none"> • Ability to understand different types of forces and motion including linear, angular, circular and parabolic motions. • Definition of elasticity –Definition of stress and strain -the units and dimensional formulae for stress and strain- Hooke's law & Young's Modulus.
3.	Viscosity & Surface Tension	14	<ul style="list-style-type: none"> • Definition & Explanation of Surface tension with reference to molecular theory - Definition of angle of contact - Definition of capillarity -The formula for surface tension based on capillarity - Explanation of concept of Viscosity - Examples for surface tension and Viscosity - Newton's formula for viscous force- Definition of co-efficient of viscosity-The effect of temperature on viscosity of liquids and gases - Poiseuille's equation for Co-efficient of viscosity
4.	Heat Transfer, optics and laser	13	<ul style="list-style-type: none"> • Modes of heat transfer and their examples. • To understand applications of optics using basic fundamentals of Physics. • To understand working principle of a LASER, components and working of different laser system and their engineering applications.
Total No. of Hours		54	

Text Books:

- R.K.Gaur and S.L.Gupta., "Engineering Physics", Dhanpat Rai Publications (AllUnits). 2012
- Dr. P Mani , "Engineering Physics" Dhanam Publications, 2012

Reference Books:

- David Halliday and Robert Resnick, "Physics Part I& II" John Wiley & Sons, 1966
- K. Ilangovan, "Engineering Physics I", MJP Publisher; First Edition, 2021

Course Outcomes

Upon Completion of this course the students will be able to

- Understand the different systems of units and knowledge of scalar and vector quantities.
- Understand the use of laser as light sources for low and high energy applications.
- Know many modern devices and technologies based on optical fibres.
- Gain various material properties which are used in engineering applications and devices.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	3	2	1	1	1	2	3	2
CO2	3	3	2	1	1	1	1	2	2
CO3	3	3	2	1	1	2	1	3	2
CO4	3	3	2	1	1	2	1	3	2

Course Type	Course Code	Name of Course	L	T	P	Credit
Core	MMT 104	Electrical and Electronics Engineering	43	11	-	03

Course Objective

The objective of this course is to develop basic knowledge of Electrical circuits and machines for specific types of applications, give a complete exposure on electrical components, impart knowledge on Magnetic-circuit analysis and introduce magnetic materials, develop their skills to understand basics of analog and digital electronics also educate on the construction and working of common electronic devices.

Learning Outcomes

- To develop their skills to understand basics of analog and digital electronics.
- To educate on the construction and working of common electronic devices.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Concept of AC & DC Current	4	<ul style="list-style-type: none"> • Describe the characteristics of AC & DC circuits.
2.	DC Generators & Motors	15	<ul style="list-style-type: none"> • Describe how generators use magnetic induction. • Describe the DC generator, DC Motor & its construction, principle of operation, types & Its applications. • Distinguish between single phase and three phase power supply.
3.	Transformers	15	<ul style="list-style-type: none"> • Describe voltage transformers. • Describe the basic types of transformer cores. • Describe transformer connections.
4.	Power Distribution Systems, Safety and Logic Gates	20	<ul style="list-style-type: none"> • Describe common power distribution systems. • Describe the process of converting Ac to DC. • Describe ways to reduce electrical safety risks. • Describe semiconductor materials, basic electronics & logic gates and their basic applications.
	Total No. of Hours	54	

Text Books:

- R. Muthu Subramanian, "Basic Electrical & Electronics Engineering", TataMcGrawHill, Second Edition, 2009
- Nagsarkar T. K. and Sukhija M. S., "Basics of Electrical Engineering", Oxford Press, 2005
- Mehta V. K., "Principles of Electronics", S.Chand & Company Ltd, 1994
- B.L. Theraja, "Fundamentals of Electrical and Electronics Engineering", S.Chand & Co. 2006.

Reference Books:

- KB Raina & S.K. Bhattacharyya, "Electrical Design Estimating and Costing", Tata McGraw Hill Publishing 1991
- Gary Dummy, "Introduction to Programmable Logic Controls", Thomson Debnar Learning Second edition, 2003.
- B.L.Theraja& A.K. Theraja, "Electrical Technology Vol. I & II", S.Chand & Co. Ltd.,2014

Course Outcomes:

Upon Completion of this course the students will be able to

- Develop an inherent understanding of the circuit analysis, basic concepts of electrical machines, house wiring and basics of electronics and be able to apply them in practical situation
- Develop the knowledge of semiconductor physics and various devices and their characteristics.
- Have ability to acquire the knowledge on magnetic circuits and DC machines, transformers.
- Have awareness of various equipment on electrical safety.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	3	2	1	1	1	2	3	2
CO2	3	3	2	1	1	1	1	2	2
CO3	3	3	2	1	1	2	1	3	2
CO4	3	3	2	1	1	2	1	3	2

Course Type	Course Code	Name of Course	L	T	P	Credit
Core	MMT 105	Environmental Science	43	11	-	03

Course Objective

The objective of this course is to impart the principal of energy systems, explore the environmental impact of various energy sources and the effects of different types of pollutants and understand the importance of environment by evaluating its impact on the human world, visualize the surrounding environment and its value.

Learning Outcomes

- Students will understand environmental aspects, which shall provide an insight into various environment related issues.
- Students will realize that the environmental studies as an interdisciplinary academic field that integrates physical, chemical and biological sciences with the study of the environment.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Environment and Ecosystem	14	<ul style="list-style-type: none"> • Scope and importance of environmental science, effect of human activities on environment • Know the concept of eco-system, structure and function.
2.	Natural Resources	13	<ul style="list-style-type: none"> • Awareness about natural resources, forest resources, exploitation, deforestation. • Awareness about water resources, food resources, mineral resources, land resources and energy resources.
3.	Pollution and its affects	14	<ul style="list-style-type: none"> • Awareness about environmental pollution such as air, water, land, thermal, and water conservation, global warming, ozone layer depletion.
4.	Environmental Education	13	<ul style="list-style-type: none"> • Knowledge about environmental protection acts and disaster management system; types and policies.
Total No. of Hours		54	

Text Books:

- Shashi Chawla, "A Textbook of Environment Studies", McGraw Hill Education, 2017.
- Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, 2006.

Reference Books:

- R. Rajagopalan, "Environmental Studies from Crisis to Cure", Oxford University third edition, 2015.
- Gilbert M Masters, "Introduction to environmental engineering and science", 2nd Edition, Prentice Hall, 2003.
- G. Tyler Miller and Scott, "Environmental Science", Cengage Learning India, 2014.

Course Outcomes:

Upon Completion of this course the students will be able to

- Understand environmental problems arising due to engineering and technological accomplishments and the science behind those problems.
- Have awareness about natural resources
- Have awareness about various types of environmental pollutions and their causes
- Have knowledge about various environmental protection acts and policies.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	1	0	0	1	3	1	3	1	1
CO2	1	0	0	1	3	2	3	1	1
CO3	1	1	1	2	3	2	3	1	1
CO4	1	1	1	1	3	2	3	1	1

Course Type	Course Code	Name of Course	L	T	P	Credit
Core	MMTL 101	Engineering Physics Lab	-	-	54	1.5

Course Objective

This course is designed with some fundamental principle, laws and information to help the students to apply the basic concepts of physics to solve engineering problems. The study of basic principles and concepts of motion, light, electricity, and modern physics will help in understanding the technology courses where emphasis is on the applications of these principles in engineering and technology.

Learning Outcomes

- Estimate errors in measurement of physical quantities.
- Apply laws of motion in various applications.
- Apply non-uniform bending methods to calculate Young's Modulus.
- Use basic principles of light, X-rays and Laser in related engineering problems.
- Communicate clearly the understanding of various experimental principles, instruments/setup, and procedure.

Exercise No.	Topics / Practical Outcomes	Lecture Hours
1	Determination of thickness of a metal wire using screw gauge	04
2	Determination of diameter of a cylindrical bar using Vernier Calliper	04
3	Determination of time period of simple pendulum.	06
4	Experiment to verify Hooke's law	04
5	Experiment to verify Lami's law	04
6	Determination of focal length of convex lens	05
7	Determination of focal length of concave lens	05
8	Determination of Young's modulus using non-uniform bending method	06
9	Determination of moment of inertia and rigidity modulus using torsional pendulum	07
10	Determination of Thermal conductivity of bad conductor by Lee's disc method	06
11	Determination of Viscosity of given liquid by Stoke's method.	03
Total No. of Hours		54

Course Outcomes:

- To be capable of understanding of physics concepts applied in optics, thermal physics and properties of matter.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	2	2	1	2	1	1	3	2

Course Type	Course Code	Name of Course	L	T	P	Credit
Core	MMTL 102	Electrical & Electronics Engineering Lab	-	-	54	1.5

Course Objective

- To introduce the students, the fundamentals of AC & DC Circuits.
- To explain the basic components of electrical engineering.
- To acquaint with the fundamental concepts of various electronic devices.
- To make them understand and analyse the electronics, digital circuit and microprocessor programs.

Learning Outcomes

- Students will be able to understand the fundamentals of AC & DC Circuits.
- To make them identify basic components of electrical engineering.
- To understand basic measurement of power characteristics of various semiconductor devices.
- To be able to identify and understand various electronics components and their uses in practical circuits.

Exercise No.	Topics / Practical Outcomes	Lecture Hours
A-Electrical Engineering Lab		
1.	Study of measuring instruments – Ammeter – Volt meter – Watt meter	04
2.	Determination of resistance by Ohm's Law	03
3.	Energy measurement in a single-phase circuit using Lamp Load	03
4.	Power measurement in a single-phase circuit	02
5.	Load test on a Single-Phase Transformer	03
6.	Load test on a Single-Phase Induction Motor	03
7.	Verification of series and Parallel Circuit	03
8.	Study of DC & AC Machine Starters	06
B - Electronics Engineering Lab		
1.	Characteristics of PN Junction Diode	04
2.	Characteristics of Transistor	03
3.	Construction of Bridge Rectifier	03
4.	Verification of Logic Gates	02
5.	Characteristics of Photo Diode, LED and Thermistor & Zener Diode	03
6.	Measurement using CRO and Megger	06
7.	Study of Microprocessor, Microcontroller & Drives	06
Total No. of Hours		54

Course Outcomes:

To be capable of understanding and handling of electrical equipments, electronic measurements for basic maintenance of workshop/ shop floor.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	2	2	1	2	1	1	3	2

Course Type	Course Code	Name of Course	L	T	P	Credit
Core	MMTL103	Workshop Practice	-	-	144	04

Course Objective

- To understand how different objects can be made from the given raw material by using hand tools.
- To introduce students to the basic workshop tools and safety.
- To impart knowledge of using measuring instruments to check the dimensions and to produce jobs with proper fit and finish.

Learning Outcomes

- Acquire skills in basic engineering practice.
- Identify the hand tools and instruments.
- Gain measuring skills.
- Read and use a production drawing as a definition for the manufacturing of a part.
- Select proper tools and instruments to complete the process.

Exercise No.	Topics / Practical Outcomes	Lecture Hours	Remarks
1.	Familiarization of workshop tools & safety aspects	16	
2.	State the purpose/ use of Hand tools and marking tools	14	
3.	Explain the purpose of Holding devices, cutting and striking tools	10	
4.	Study and Practice on Measuring Instruments / Equipments	24	
5.	Filing and Fitting Practice	54	
6.	Pedestal grinding - Safety precautions – Sharpening of cutting tools - single point, form tools etc.	26	
	Total No. of Hours	144	

Course Outcomes:

The student will be capable of identifying and using holding devices, cutting, striking tools, measuring instruments/ equipments, pedestal grinding.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO	1	2	3	2	3	1	0	1	3

SEMESTER - II

Course Type	Course Code	Name of Course	L	T	P	Credit
Core	MMT 201	Communication English-II	43	11	-	03

Course Objective

- The objective of this course is to develop a level of proficiency for independent and effective communication for academic, professional and social requirements, enable the students to use English effectively for the purpose of understanding technical information in their field/ branch of study also course teaches Listening to different speech styles and comprehensive writing, reading, speaking techniques.

Learning Outcomes

- To enable the students, use English effectively for the purpose of understanding technical information in their field/ branch of study. Listening to different speech styles and comprehensive writing, reading, speaking techniques.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Basics of Vocabulary and Sentences	14	<ul style="list-style-type: none">• Understand homophones, homonyms, articles and compound words, dialogue writing, question tags, vocabulary learning• Learn to write simple and complex sentences.
2.	Active and Passive Voices, Idioms and Phrases	13	<ul style="list-style-type: none">• Understand Active and Passive voices• Usage of Idioms and phrases.
3.	Synonyms and Antonyms and Letter Drafting	13	<ul style="list-style-type: none">• Knowledge of Synonyms and Antonyms.• Write and read process chart and technical letters.
4.	Communication Protocol, Errors and Forms & Reports	14	<ul style="list-style-type: none">• Ensure communicate with people in respectful form and manner in line with organizational protocol.• Finding out common errors in a sentence & corrections.• Knowledge on filling up of forms and writing technical report.
Total No. of Hours		54	

Text Books:

- Viswamohan, Aysha, "English for Technical Communication", Tata McGraw Hill, 2008.
- Regional Institute, "English for Engineers" Cambridge University Press, 2006.
- A.S. Hornby, "The Advanced Learners dictionary of Current English" Oxford University Press, 2004.
- Wren and Martin, "High school English Grammar and Composition". S.Chand & co., Ltd. 2017
- GlennisPye, 'Vocabulary in Practice – Part 1 to 4', Cambridge University Press, 2004.

Reference Books:

- Michael Swan “Basic English Usage”, EBS/OUP, 1989.
- Muralikrishna and Sunita Mishra “Communication Skills for Engineering”, Pearson Education India; Second edition 2011.
- M. Thomas, “Common Errors in English”, Lotus Press, 2006.
- Shiv K Kumar & Hemalatha Nagarajan, “Learn Correct English”, Pearson Education India, 2005.

Course Outcomes:

Upon Completion of this course the students will be able to

- Enhance their writing, reading and listening skills.
- Understand English speech, sound system, stress and intonation
- Learn vocabulary with wide range.
- Express in a significant manner to different levels of people in educational and communal fields.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	3	2	2	1	1	2	3	2
CO2	3	3	2	2	1	1	2	3	2
CO3	3	3	2	2	1	1	2	3	2
CO4	3	3	2	2	1	1	2	3	2

Course Type	Course Code	Name of Course	L	T	P	Credit
Core	MMT 202	Engineering Mathematics	43	11	-	03

Course Objective

- This course is designed to cover the topics such as Vector calculus, transform techniques to solve linear and partial differential equations were widely used in various fields, acquire mathematical concepts and methods.

Learning Outcomes

- This course is designed to cover the topics such as Vector calculus, transform techniques to solve linear and partial differential equations were widely used in various fields.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Matrices	14	<ul style="list-style-type: none"> Concepts, notation, order, equality, types of matrices Zero and identity matrix, transpose of a matrix, symmetric and skew symmetric matrices. Operation on matrices: Addition and multiplication and multiplication with a scalar. Simple properties of addition, multiplication and scalar multiplication Determinants upto 3x3 matrix Minors, co-factors and applications of determinants in finding the area of a triangle. Ad-joint and inverse of a square matrix. Solving system of linear equations in two or three variables (having unique solution) using inverse of a matrix and Cramer's rule.
2.	Complex Numbers and Differential Calculus	14	<ul style="list-style-type: none"> Introduction. Algebra of Complex Numbers (Addition, Subtraction, Multiplication & Division) and its properties. Modulus & Conjugate of Complex Numbers. Cartesian representation of a complex number Argand diagram De-Moivre's theorem – simple problems Functions and Limits: Concept of function and simple examples, Concept of limits with examples. Derivatives: Concept of derivatives (Physical meaning of derivative) Rules of derivatives such as sum, product, quotient of functions, Derivative of composite function (chain Rule), implicit and parametric functions, Derivatives of inverse, logarithmic and exponential functions

			<ul style="list-style-type: none"> • Find the order and degree of given differential equation(s) • Form simple differential equations for given simple engineering problems
3.	Integration	13	<ul style="list-style-type: none"> • Indefinite Integration: • Solve the given simple problem(s) based on rules of integration. • Obtain the given simple integral(s) using substitution method. • Integrate the simple functions using the integration by parts • Definite Integration: • Solve the given simple problem(s) based on properties of definite integration • Apply the concept of definite integration to find the area under the curve(s)
4.	Vectors and Probability	13	<ul style="list-style-type: none"> • Vectors and scalars, magnitude and direction of a vector. • Types of vectors (equal, unit, zero, parallel and collinear vectors), position vector of a point, negative of a vector, components of a vector, addition of vectors, multiplication of a Vector by a Scalar & Vector • Probability distribution: Discrete Probability distribution, continuous Probability distribution • Binomial distribution • Poisson's distribution • Normal distribution
Total No. of Hours		54	

Text Books:

- P.Krishnamurthy, N.Thangasamy, "Mathematics for Polytechnic Colleges" K.V.Publications, 2009
- Tamil Nadu Text Book Cooperative Society, "Higher Secondary Mathematics - First Year" 2007
- Dr.M.K.Venkatraman, "Engineering Mathematics", National Publishing Co, Chennai 1965

Reference Books:

- Dr.P. Kandasamy & Others, "Engineering Mathematics", S. Chand & Co Ltd., 2006
- H.K Daas, "Advanced Engineering Mathematics", S Chand Publishing, 2019

Course Outcomes:

Upon Completion of this course the students will be able to

- Identify different types of matrices and apply matrix algebra, determinants to solve the system of linear equations up to third order by Cramer's rule.
- Understand the properties of the Cartesian representation of a complex number and able to apply De Moivre's theorem.
- Apply the techniques of calculus such as derivatives, integrals to solve problems involving product rule, successive differentiation, formation of differential equation up to second order, partial derivatives and able to describe 2D, 3D shapes.
- Apply probability concepts to solve related simple problems

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	3	2	2	1	1	2	3	2
CO2	3	3	2	2	1	1	2	3	2
CO3	3	3	2	2	1	1	2	3	2
CO4	3	3	2	2	1	1	2	3	2

Course Type	Course Code	Name of Course	L	T	P	Credit
Core	MMT 203	Engineering Chemistry	43	11	-	03

Course Objective

- This course enables to develop basic concepts of atomic and electronic configuration, familiarize students to water chemistry, basic organic chemistry, electro chemistry also to learn types of fuels, calorific value calculations, and manufacture of solid, liquid and gaseous fuels.

Learning Outcomes

- Overview of key concepts of Chemistry.
- To provide the students with a fundamental understanding of structure & bonding, water chemistry, organic chemistry and fuels, electro chemistry & basic concepts of thermodynamics.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Atomic Structure & Bonding	13	<ul style="list-style-type: none"> • Basic concepts of atomic structure and chemical bonding (Covalent, Ionic, Hydrogen, Coordinate Bonds) and electronic configuration.
2.	Electrochemistry	14	<ul style="list-style-type: none"> • Knowledge on acids, bases, solutions, Conductors, insulators, electrolytes– electrolysis – Faraday's laws of electrolysis numerical problems – Galvanic cell – standard electrode potential – electrochemical series– emf and numerical problems on emf of a cell
3.	Water Chemistry and Organic Chemistry	14	<ul style="list-style-type: none"> • Introduction – soft and hard water–causes of hardness–types of hardness –disadvantages of hard water – degree of hardness (ppm) – softening methods – Permutitprocess – ion exchange process– drinking water – osmosis, reverse osmosis – applications of reverse osmosis. • Overview of preparation and identification of organic compounds.
4.	Fuels and Basic concepts of thermodynamics	13	<ul style="list-style-type: none"> • Understand different types of fuels & its extractions – characteristics of good fuel-composition and uses of gaseous fuels. • Understand basic concepts and terms of thermodynamics, thermodynamic processes, heat and work concept with expressions.
	Total No. of Hours	54	

Text Books:

- Shashi Chawla, "Text Book of Engineering Chemistry", Dhanpat Rai & Co. 2017.
- BS Bahl, Arun Bahl, "Text book of Organic Chemistry", SChand, 2017.
- P.L. Soni, "Text Book of Inorganic Chemistry", Sultan Chand & Co., 2013.

Reference Books:

- Bahl, Tuli & Madan, "Essential Topics in Physical Chemistry" Sultan Chand & Co., 2010.
- M.M. Uppal & Pooja Bhagat, "Engineering chemistry", Khanna Publishers, 2011.

Course Outcomes:

Upon Completion of this course the students will be able to

- Understand basic concepts of atomic structure, chemical bonding and electronic configuration.
- Acquire the basic knowledge about water chemistry and able to identify acid & base.
- Understand different types of fuels & methods of its extractions and basic concept of electrochemistry & its application.
- Understand the basic concepts of thermodynamics processes and also able to identify the organic compounds.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	2	1	2	2	2	2	3	2
CO2	3	2	1	2	2	2	2	3	2
CO3	3	2	1	2	2	2	2	3	2
CO4	3	2	1	2	2	2	2	3	2

Course Type	Course Code	Name of Course	L	T	P	Credit
Core	MMT 204	Computer & Information Technology	43	11	-	03

Course Objective

- To inculcate the Basic Computer Operation and Preparing / Maintaining Documents through Office Suit applications.

Learning Outcomes

- Able to use the computer, understand basic operations and its parts, operating systems and Office Suit applications.
- Able to create documents, presentations and use computer communication and internet for daily activities.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Introduction to Computer Systems and Windows & Operating System	13	<ul style="list-style-type: none"> • Describe different parts of computers & its operating systems. • Understanding windows operating system & its functions. • Knowledge on Office Suit applications.
2.	Application of Computer and Presentation Tool	14	<ul style="list-style-type: none"> • Application of computer & communication for documentation Work. • Preparation of presentation.
3.	Application of the Specified Type of Network Connecting Device	13	<ul style="list-style-type: none"> • Learn about Computer communication like PAN, LAN, MAN, WAN & Bluetooth.
4.	Internet	14	<ul style="list-style-type: none"> • World Wide Web- Introduction to Internet, Intranet, Cloud, Websites, Web Pages, URL, Web Servers, basic setting of web browser history, extension, default page, default search engine, creating and retrieving book marks, use search engines effectively for searching the content. • Web services-e-Mail, Chat, Video Conferencing, e-Learning, e-Shopping, e-Reservation, e-Groups, Social Networking.
Total No. of Hours		54	

Text Books:

- V Rajaraman, "Fundamentals of Computers", Prentice Hall India Learning Private Limited, 2003.
- Pradeep K Sinha, Priti Sinha, "Computer Fundamental 6th Edition" BPB Publication, 2017.

Reference Books:

- Rajaraman V, Adabala N, "Fundamentals of Computer Engineers", Prentice Hall India Learning Private Limited; 6th Edition, 2014.

Course Outcomes:

Upon Completion of this course the students will be able to

- Understand the components of Computers.
- Explore different approaches to troubleshoot computer communication.
- Recognize the technological trends of Computer Networking and evaluate the challenges in building networks.
- Realize the need of internet on day-to-day activities.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	3	3	2	2	3	3	1	2
CO2	3	3	1	1	1	1	3	1	2
CO3	3	3	3	2	2	2	3	1	1
CO4	2	2	2	1	1	2	3	2	2

Course Type	Course Code	Name of Course	L	T	P	Credit
Core	MMT 205	Development of Life Skills	43	11	-	03

Course Objective

- To identify the core values that shapes the ethical behaviour of a professional.
- To enable the students to create an awareness on ethics and Human values.
- To appreciate the social and moral values of others.

Learning Outcomes

- To enable the students to create an awareness on ethics and Human values.
- To appreciate the social and moral values of others.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Ethics, Motivation & Morals	12	<ul style="list-style-type: none"> • Study of personality development, ethics, moral & professional values and critical thinking. • Understanding of theory of motivation, attitude and aptitude.
2.	Management and Team Work	14	<ul style="list-style-type: none"> • Study of time management, stress & conflict management, problem solving and decision making. • Importance and necessity of working in a team.
3.	Health & Body Language	14	<ul style="list-style-type: none"> • Knowing the importance of health and understanding body languages. • Discussion of interview techniques and group discussion.
4.	Human Values	14	<ul style="list-style-type: none"> • Universal Human Values: Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Right Understanding, Relationship and Physical Facility, Exploring Human Consciousness & Natural Acceptance-Harmony in family, Human-to-Human Relationship, Exploring Feeling of Trust, Respect, Natural Acceptance of Human Values.
Total No. of Hours		54	

Text Books:

- Butterfield Jeff, "Soft Skills for Everyone", Cengage learning India, 2011.
- Mike W Martin and Roland Schinzinger, "Introduction of Engineering Ethics", McGraw-Hill Education, Second Edition, 2009.

Reference Books:

- R. R. Gaur, R. Sangal and G. P. Bagaria, "A Foundation Course in Human Values and Professional Ethics", Excel Books, 2010.

Course Outcomes:

Upon Completion of this course the students will be able to

- Absorb soft skills to excel in interpersonal skills.
- Gain skills on time management and conflict management.
- Have exposure on professional, ethical and human values.
- Confer the ethical issues, responsibilities & rights in the social environment.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	1	0	0	1	3	1	3	1	1
CO2	1	0	0	1	3	2	3	1	1
CO3	1	1	1	2	3	2	3	1	1
CO4	1	1	1	1	3	2	3	1	1

Course Type	Course Code	Name of Course	L	T	P	Credit
Core	MMTL201	Engineering Chemistry Lab	-	-	54	1.5

Course Objective

- Provide the students with a solid foundation in principles of chemistry required to solve engineering problems.
- Practical implementation of fundamental concepts.

Learning Outcomes

The Experiments will make the students to gain skills on:

- Estimation of hardness of water.
- Estimation of concentration of acids.
- Determination of pH values.
- Preparation of various solutions.

Exercise No.	Topics / Practical Outcomes	Lecture Hours
1.	Volumetric Analysis	05
2.	Acidimetry – Alkalimetry	05
3.	Estimation of Hydrochloric Acid	05
4.	Estimation of Sulphuric Acid	04
5.	Estimation of Sodium hydroxide given standard Sodium Carbonate solution & Hydrochloric Acid as a link solution	05
6.	Permanganometry - Estimation of Potassium Permanganate and Estimation of strength of Oxalic Acid	05
7.	EDTA Titration - Estimation of total hardness of water for the water sample	03
8.	pH Determination - Determination of pH using pHmeter	10
9.	Preparation of Standard Solutions - Preparation of 1N, 0.5N & 0.1N solution of Sodium Carbonates and Preparation of 1N Solution of Oxalic Acid.	12
Total No. of Hours		54

Course Outcomes:

- Understand the basic laboratory techniques and preparation of standard solutions, titration and volumetric analysis.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO	3	3	3	2	3	1	0	3	2

Course Type	Course Code	Name of Course	L	T	P	Credit
Core	MMTL 202	Communication Lab	-	-	144	04

Course Objective

- To facilitate the students for improving their listening, speaking, reading and writing skills in English language, so as to use it as a tool to aid professional advancement.

Learning Outcomes

Students can be able to:

- Make logical communications orally as well as in writing.
- Produce technical documents and reports.
- Communicate their ideas effectively.

Exercise No.	Topics / Practical Outcomes	Lecture Hours
1.	LISTENING practical to develop comprehension	24
2.	SPEAKING practical to learn voice modulation and situational conversation/role-playing	36
3.	Learn READING and comprehension, and develop enriched vocabulary	24
4.	To learn art of WRITING both official and Business Correspondence	24
5.	Learn how to participate in group discussions, mock interviews.	36
	Total No. of Hours	144

Course Outcomes:

- To be capable of communicating- listening, speaking, reading and writing in English, so as to use it as a tool to aid professional advancement.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO	0	2	1	0	0	3	3	1	1

Course Type	Course Code	Name of Course	L	T	P	Credit
Core	MMTL 203	Computer Engineering Lab	-	-	54	1.5

Course Objective

- To impart the knowledge of various hardware components of a computer.
- To provide the skill of assembling the computer, formatting and installing operating system.
- To impart the knowledge and usage of various Office Suit applications such as Word Processor, Spreadsheet and Presentation.

Learning Outcomes

- Gaining the knowledge and usage of computer hardware and Office Suit applications such as Word Processor, Spreadsheet and Presentation.

Exercise No.	Topics / Practical Outcomes	Lecture Hours
1.	Study of Computer Components	3
2.	Installation of Operating System	3
3.	Practice of Computer Booting Process using Operating System	3
4.	Demonstration of Operating System Environment	3
5.	Practice - using My Computer, OS Explorer	3
6.	Practice-using Control Panel	3
7.	Practice - CD and DVD Writing	3
8.	Practice –Digital Painting	3
9.	Practice – My Network Places	3
10.	Demonstration of Network	3
11.	Exercise Based on Word Processor application - Document Preparation, Printing Document, Mail Merge usage, Draw Table	3
12.	Exercise Based on Spreadsheet application - Data Preparation, Printing Data, Database usage, Draw Charts	3
13.	Exercise Based on Presentation application - Creating Slide, Adding Slide, Animations in Slide, Slideshow presentation	6
14.	Searching Web Page/Site / Content using Search Engines	6
15.	Creating e-mail Account, Sending and Receiving E-mails	6
	Total No. of Hours	54

Course Outcomes:

- Identify various hardware components of a system.
- Apply the different tools and utilities of the operating system.
- Study to use the Internet safely, legally, and responsibly.
- Learn basic word processing, Spreadsheet and Presentation Graphics Software skills.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	1	2	1	2	2	3	3	3	3
CO2	3	2	1	2	1	2	2	1	2
CO3	2	2	1	1	2	3	3	2	1
CO4	2	2	1	1	3	2	2	1	1

SEMESTER - III

Course Type	Course Code	Name of Course	L	T	P	Credit
Core	MMT 301	Applied Mechanics & Strength of Materials	43	11	-	03

Course Objective

- To provide a comprehensive knowledge of force, work and energy to calculate work done, power required and efficiency for various simple machines.
- To understand the importance and application of various laws of mechanics.
- To understand the nature of stresses induced in material under different loads.
- To plot the variation of shear force and bending moments over the beams under different types of loads.

Learning Outcomes

- To learn the fundamental of different forces and its application, and problem solving of engineering materials loads and strength.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Basics of Forces	06	<ul style="list-style-type: none">• Understand Principles of Equilibrium of Forces.• Knowledge of Lami's theorem.• Understand the Converse of the law of triangle of forces.• Laws of polygon of forces and Conditions of equilibrium.
2.	Centroid and Moment of Inertia	12	<ul style="list-style-type: none">• Understand centroid, Methods of centre of gravity of simple figures.• Knowledge of Centre of gravity by geometrical.• Understand Moment of inertia.• Understand Methods for finding out Moment of inertia.
3.	Frictions	06	<ul style="list-style-type: none">• Knowledge of Types of friction and Laws of friction• Application of Friction
4.	Simple Machines	06	<ul style="list-style-type: none">• Knowledge of Simple Lifting Machines
5.	Simple Stress & Strain and Shear Force & Bending moment	24	<ul style="list-style-type: none">• Understand types of loads, stresses & strains(axial and tangential), Hooke's law, Young's modulus, bulk modulus, modulus of rigidity, Poisson's ratio, derive the relation between three elastic constants• Types of Beams & load• Concepts of Shear Force and Bending Moment

			<ul style="list-style-type: none"> • Knowledge on Shear Force and Bending Moment diagram and its salient features, illustration in cantilever beam, simply supported beam and over hanging beam under point load and uniformly distributed load
	Total No. of Hours	54	

Text Books:

- R.S. Khurmi, N Khurmi, "Applied Mechanics", S Chand, 2010.
- R K Bansal, "A Textbook of Strength of Materials", 4th Edition, Laxmi Publications, 2011.
- I.B. Prasad, "A Textbook of Strength of Material" Khana Publisher, 1988.
- Basudev Bhattacharya, "Engineering Machines", Second Edition, Oxford University Press, 2016.

Reference Books:

- Ferdinand P. Beer, E. Russell Johnston and Jr. John T. DeWolf "Mechanics of Materials", Tata McGraw-Hill, Third Edition.
- S.S. Rattan, "Strength of Materials", McGraw Hill Education (India) Pvt. Ltd., 2nd Edition 2013.

Course Outcomes:

Upon completion of the subject, the student will be able to:

- Define and classify the forces and its system.
- Understand composition of forces and apply it to solve problems
- Draw the shear force and bending moment diagrams for the beam subjected to different loading.
- Evaluate stresses induced in different cross-sectional members subjected to shear loads.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	3	2	2	1	1	2	3	3
CO2	3	3	3	2	3	1	2	3	3
CO3	3	3	3	3	3	1	2	3	3
CO4	3	3	3	3	3	1	2	3	3

Course Type	Course Code	Name of Course	L	T	P	Credit
Core	MMT 302	Engineering Metrology	43	11	-	03
Course Objective						
<p>This course aims to provide basic knowledge and hands on experience on:</p> <ul style="list-style-type: none"> • Inspection of engineering parts with various precision instruments. • Design of part, tolerances and fits. • Principles of measuring instruments and gauges and their uses. • Evaluation and inspection of surface roughness. • Inspection of product using advanced precision tools. • Machine tool testing to evaluate machine tool quality. 						
Learning Outcomes						
<ul style="list-style-type: none"> • To learn and develop skills on quality checking for engineering parts, moulds, machining components by different measuring instruments and advanced techniques 						
Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome			
1.	Introduction to Limits, Fits and Tolerances	12	<ul style="list-style-type: none"> • Introduction to Metrology, objectives of Metrology, Need of Inspection, Measuring Instruments, Methods of measurement, Requirements & General care of instruments, Sources of Errors & Corrections of Errors, Accuracy and Precision. • Study of Limits, Fits and Tolerances. • Understanding Geometric Dimensioning & Tolerances. • Describe Standards of Measurements. 			
2.	Measuring Instruments and Marking tools	15	<ul style="list-style-type: none"> • Measuring Instruments - construction, application and least count. Steel rule, Pi Tape, Try square, Vernier callipers, and Vernier height gauges, micrometers, outside & inside depth micrometer, height Master, Bore gauges, slip gauges & Pin Gauges. • Comparators – Introduction & types of comparators, uses of comparators, difference between measuring instruments & comparators, mechanical comparators – Dial indicators, advantages & disadvantages, working principle of pneumatic comparators – solex air gauge, applications • Standard Gauges – Types of gauges, Radius gauge, Feeler gauge, Pitch Screw gauge, Taper wire & Thickness gauge, Plain gauge, Plug gauge, Snap gauge, Ring gauge, Combined limit gauge. • Marking Tools – Scriber, surface gauges, dividers, V-blocks, Engineer's Parallels, Angle plates, surface plates. 			

3.	Angular Measurement and Measurement of Surface Finish	12	<ul style="list-style-type: none"> • Angular & Taper measurements – Bevel Protractors and its types, combination set, Sine bar, Sine table and Sine centre, Angle gauges, Auto Collimator, Measurement of Taper using balls & Rollers. • Geometrical Measurements Straightness, Flatness, Parallelism, Squareness, concentricity. • Measurement of Surface Finish-Representation of surface finish as per BIS, Methods of measuring surface finish, Surface finish measuring machines, Surface roughness, guide for selection, surface roughness obtainable from various manufacturing processes, surface roughness symbols, Hardness testing.
4.	Advanced Measuring Equipment's	15	<ul style="list-style-type: none"> • Precision instruments based on laser, Principles - laser interferometer & application in measurements and machine tool metrology, Toolmakers microscope, Optical profile projector, Co-ordinate measuring machines – with & without scanner (non –contact & contact types), Optical flats – types and uses, Computer aided inspection and continuous Measuring gauges, Ultrasonic Gauges
	Total No. ofHours	54	

Text Books:

- M.Mahajan, "A text Book of Metrology", Dhanpat Rai & Co. New Delhi, First Edition, 2010.
- R.K.Jain, "Engineering Metrology", Khanna Publisher, special Edition, 2022.
- I.C. Gupta, "A Text Book of Engineering Metrology", Dhanpat Rai Publications, 2018.

Reference Books:

- Alsutko, JerryD.Faulk, "Industrial Instrumentation", Cengage Asia Pvt. Ltd., 2002.

Course Outcomes:

Upon completion of the subject, the student will be able to:

- Identify the objectives of metrology in engineering and acquire knowledge of various standards of measurements and requirement of Inspection and error correction, limits, fits and Tolerances.
- Apply different methods to use the marking and measuring tools like surface plate, micrometer and height gauge etc. Understand the general principle of limit gauging and use of various gauges for inspection.
- Describe the working principle of auto collimator, CMM and list the applications of them.
- Explain the various angular measurement systems and measurement of flatness, surface finish.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	3	3	3	1	1	3	3	1
CO2	3	3	3	2	1	1	2	3	1
CO3	3	3	3	3	1	1	1	3	1
CO4	3	3	3	3	1	1	2	3	2

Course Type	Course Code	Name of Course	L	T	P	Credit
Core	MMT 303	Machine Shop Technology-I	43	11	-	3

Course Objective

This course aims to provide basic knowledge and hands on experience on:

- To understand the basics of metal cutting and chip formation theory
- To understand how different objects can be made from the given raw material by using different machine tools.
- To introduce students to the basic concepts of manufacturing via Lathe, Shaping, Slotting and Drilling machines
- To develop a knowledge of appropriate parameters to be used for various machining operations.

Learning Outcomes

- To learn and develop skills on Different machines for manufacturing of mould parts, Machining components on Lathe, Shaping and drilling machines

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Theory of Metal Cutting	10	<ul style="list-style-type: none"> • Overview of metal cutting theory and chip formation. • Distinguish between single-point multi-point cutting tools. • Describe how tool angles affect Cutting processes. • Describe the functions and methods of chip control. • Describe the occurrence of built-up edge. • Describe reasons for using cutting fluids. • Identify the major categories of cutting fluids, cutting variables and their significance
2.	Lathe Machine	20	<ul style="list-style-type: none"> • Explain Construction and working principle of lathe machine • Draw the sketch of lathe and write the functions of each part. • Identify and demonstrate different parts of lathe. • Explain lathe operations & tools used. • Describe the cutting variables for the lathe. • Understanding different work holding and Tool holding Devices.
3.	Shaping, Planning and Slotting Machine	14	<ul style="list-style-type: none"> • Describe the Shaping, Planning & Slotting Machines and working mechanism and their operations. • Differentiate between Shaper, planner and slotting machine. • Understanding different work holding and tool holding Devices.

4.	Drilling Machine	10	<ul style="list-style-type: none"> Describe types of drilling machines. Describe drill holding devices. Describe drill geometry & nomenclature, Describe types of drills. Understanding different types of drilling operations and specifications of the machine.
Total No. of Hours		54	

Text Books:

- S.K.Hajra Choudhury, "Elements of Workshop Technology (Volume-II)", Media Publishers & Promoters, First Edition, 2010.
- B.S. Raghuwanshi, "Workshop Technology", Dhanpat Rai & Company(P) Limited, 2003.

Reference Books:

- R.K. Jain, "Production Technology", Khanna Publishers, 2001
- Rajendra K. Jain, "Mechanical & Industrial Measurements", Khanna Publishers, 1988.

Course Outcomes:

On completion of the subject, the student will be able to:

- Understand mechanism of metal cutting techniques and understand how tool angles effect the cutting processes
- Acquire knowledge on working of machine tools and their operations.
- Acquire knowledge to produce different mould parts/elements by using lathe machine.
- Calculate cutting variables in Lathe, Drilling machines.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	3	3	3	1	1	3	3	1
CO2	3	3	3	2	2	1	2	3	1
CO3	3	3	3	3	2	1	2	3	1
CO4	3	3	3	3	2	1	2	3	2

Course Type	Course Code	Name of Course	L	T	P	Credit
Core	MMT 304	Engineering Drawing	43	11	-	03

Course Objective

- The student is expected to have the efficient drafting skill depending on the operational function in order to perform day to day activity. Provide neat sketch of industrial drawing. To develop the knowledge about position of the component and its forms Interpretation of technical illustrations, Preparation of machine components and related parts.

Learning Outcomes

- Understanding the drawing concepts which help them to read different view/sections/projection of solids.
- Knowledge on assembly and detailed drawings of part.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Introduction, Drawing Sheet & Layout, Aids of Drawing, Dimensioning	10	<ul style="list-style-type: none"> • Explanation of the scope and objective of Engineering Drawing • Study of drawing standard, size of drawing sheet, layout of drawing sheet • Do the drawing with the help of drawing tools like, drawing Board, mini drafter, and pencil. • Use scale and put dimension with the help of drawing tools.
2.	Geometrical Constructions	06	<ul style="list-style-type: none"> • Different geometric construction methods; line, arc, circle, tangents, regular polygons & conics sections
3.	Projections, Sections and Interpretations	24	<ul style="list-style-type: none"> • Practice on Orthographic (first angle & third angle projection) and isometric views. • Projection of Points, Lines and Planes and solids • Different sectional views, development of surfaces • Understanding perspective projections
4.	Basics of Assembly Drawing	14	<ul style="list-style-type: none"> • Exposure the need of assembly and detailing of machine parts. • Different types of couplings used for assembly and its uses. • Interpretation of fastening devices while drawing
Total No. of Hours		54	

Text Books:

- N.D. Bhatt, "Engineering Drawing", Charotar Publishing House, 2014.
- Lakshminarayan Mathur, "A Text Book Of Machine Drawing", Jain Brothers, 2020
- K.V. Natarajan, "A Test Book of Engineering Graphics", N Dhanalakshmi Publisher

Reference Books:

- M.B. Shah & B. C. Rana, "Engineering Drawing", Pearson, 2nd Edition, 2009.
- K. C. John, "Engineering Graphics", Prentice Hall of India, 1st Edition, 2009.

Course Outcomes:

On completion of the subject, the student will be able to:

- Use the drawing instruments effectively and able to dimension the given figures.
- Appreciate the usage of engineering curves in tracing the paths of simple machine components.
- Understand the concept of projection and able to draw the basic views related to projections of Lines, Planes and solids.
- To Visualize and project isometric, perspective projections of simple solids and assembly drawing of machine parts.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	3	3	3	2	2	2	3	2
CO2	3	3	3	2	2	2	2	2	2
CO3	3	2	3	3	2	2	2	3	2
CO4	3	3	3	2	2	2	2	2	2

Course Type	Course Code	Name of Course	L	T	P	Credit
Core	MMT 305	Plastic Materials& Testing	43	11	-	03

Course Objective

- Knowledge of plastic materials and their grades.
- Properties of different plastic materials and their applications in various fields according to the properties requirement.
- Testing and characterization of plastic materials.
- To understand the basic concepts of manufacturing of plastics material, properties & applications, testing & quality control for plastics materials and products.
- To develop the knowledge of national and international standards for testing methods.

Learning Outcomes

- To learn the fundamentals of different plastic materials and their application.
- To understand the basic testing procedure of plastic materials and their standards.
- To learn the various National & International standards for testing methods

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Natural Plastics	6	<ul style="list-style-type: none"> • Introduction to Natural Polymers/ Natural Plastics -their sources, methods of manufacture, properties and applications
2.	Commodity Plastics, Engineering Plastics and Thermoset Plastics	24	<ul style="list-style-type: none"> • Knowledge of Commodity Plastics – OLEFINIC, STYRENIC, VINYL, ACRYLIC, CELLULOSICS POLYMERS-Method of Manufacture – General Characteristics & Properties – Processing Behaviour and applications • Knowledge of Engineering Plastics (ABS, PS, PC, POLY AMIDES, POLY ACETAL, PET/PBT, PTFE, TPU) –Method of Manufacture – General Characteristics & Properties – Processing Behaviour and applications • Thermoset Plastics (PF, UF, MF, Epoxy, Unsaturated Polyester) - Source of Raw Materials – Methods of Manufacture – General Characteristics & Properties –Processing Behaviour and Applications
3.	Testing of Plastics	24	<ul style="list-style-type: none"> • Introduction & importance of testing • Significance of Identification of plastics. • National and International standards - BIS, ASTM, ISO. • Role of accreditation bodies. • Testing of Mechanical, Thermal, Optical, Electrical, Permeability and Rheological properties.
Total No. of Hours		54	

Text Books:

- J.A. Brydson, "Plastics Materials", Butterworth Heinemann, 1999.
- A.S. Athalye, "Plastic Materials Hand Book", Multi-Tech Publishing Company, 1980.
- Shah Vishu, "Hand Book of Plastics Testing Technology", Wiley, 1984.

Reference Books:

- Irvin I. Rubin, "Handbook of Plastics Material & Technology", Wiley, 1990.

Course Outcomes:

Upon completion of the course students will be able to:

- Have knowledge in natural polymers properties and its applications.
- Have knowledge in commodity and Engineering Plastics materials properties and its applications
- Have the knowledge of National and International standards of plastics Testing
- Have the knowledge of Testing of Mechanical, Thermal, Optical, Electrical, Permeability and Rheological properties.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	2	2	3	2	2	3	3	2
CO2	2	3	2	2	3	3	2	2	3
CO3	3	2	3	2	3	2	2	3	2
CO4	3	3	3	2	3	2	3	3	3

Course Type	Course Code	Name of Course	L	T	P	Credit
Core	MMTL301	Machine Shop Practice – I	-	-	144	04

Course Objective

The objective of Machine Shop Practice is to enable the students

1. To understand Constructional features of basic machine tools
2. To know the various Metal cutting operations and Machine tool parameters.

Learning Outcomes

Upon completion of this course, students can able to

1. Acquire skills on working with general-purpose machine tools and about various manufacturing processes.
2. Create model by demonstrating various lathe operations
3. Develop a model by demonstrating various drilling and grinding operations
4. Create model by demonstrating various shaping operations

Exercise No.	Topics / Practical Outcomes	Lecture Hours
1.	Pedestal Grinding – Safety precautions, sharpening of cutting tools –turning, facing, parting, grooving, thread cutting.	12
2.	Knowledge of Shapers, their applications, setup and Procedures for use	06
3.	Operating Shaper machine in a safe and competent manner	20
4.	Knowledge of drills and their applications, Maintenance and procedures for use.	06
5.	Understanding of basic principles of Drilling machines	06
6.	Describe principle, construction and working various kinds of drill machines & Study of cutting tools and machining operations carried out on Drilling machine	12
7.	Be able to operate Drilling machines in a safe and Competent manner –perform marking and punching, drilling and tapping and reaming, counter-boring and countersinking operations	20
8.	Knowledge of conventional lathes, their accessories, attachments and applications	08
9.	Knowledge of lathe tools and their applications.	08
10.	Knowledge of conventional lathes, maintenance and procedures for use.	08
11.	Knowledge of tapers, their attachments and applications.	06
12.	Knowledge of conventional lathe drilling, boring, reaming, tapping and threading operations.	08
13.	Be able to operate Lathe machine in a safe and competent manner	24
	Total Nos. of Hours	144

Course Outcomes:

Upon completion of the course students will be able to:

- Develop sequence of machining operations required for industry.
- Manufacture components as per the drawings.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	3	3	3	3	1	1	3	2
CO2	3	3	3	3	3	1	1	3	2

Course Type	Course Code	Name of Course	L	T	P	Credit
Core	MMTL302	Engineering Drawing Lab	-	-	54	1.5

Course Objective

The objective of Engineering Drawing Lab is to:

1. Develop basic engineering drawing skills.
2. Develop Skills in Preparation Of projections, planes, sectional views and lateral surfaces.
3. Develop Skills in Preparation of isometric projections and understand the assembly drawings.

Learning Outcomes

Upon completion of this course, students can be able to:

1. Understand the production blue prints.
2. Use the drawing instruments effectively and able to mark the dimensions properly.
3. Understand the concept of projection and acquire visualization skills, projection of points.
4. Draw the basic views related to projections of Lines, Planes, sectional views.

Exercise No.	Topics / Practical Outcomes	Lecture Hours
1.	Projection of points in different quadrants	02
2.	Projection of straight lines parallel to one or both planes, parallel to one plane, perpendicular to other, inclined to one plane and parallel to other line, inclined to both planes (in first quadrant) and finding the true length	06
3.	Projection of planes and polygonal surface—parallel to one plane and perpendicular to other plane (in first quadrant)	06
4.	Projection of simple solids for prism, pyramid, cylinder and cone when the axis is parallel to one plane and perpendicular to other plane in first quadrant.	08
5.	Sectioning of solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other, obtaining true shape of section	06
6.	Development of lateral surfaces of simple and truncated solids—prisms, pyramids, cylinders & cones. Development of lateral surfaces of solids with cylindrical cut-outs, perpendicular to the axis	12
7.	Isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones	10
8.	Study of Assembly Drawing	04
Total Nos. of Hours		54

Course Outcomes:

Upon completion of the course students will be able to:

- Understand Orthographic, Isometric projections of simple solids and assembly drawing of machine parts.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	3	3	3	3	1	1	3	2

Course Type	Course Code	Name of Course	L	T	P	Credit
Core	MMTL303	Plastics Testing Lab	-	-	54	1.5

Course Objective

The objective of Plastics Testing Lab is to enable the students:

1. To understand the basic characteristics of plastics
2. To determine various parameters and properties of plastics.

Learning Outcomes

Upon completion of this course, students can able to acquire skills on various testing techniques to calculate the properties and contents of plastic materials and products.

Exercise No.	Topics / Practical Outcomes	Lecture Hours
1.	Determination of density of plastics.	06
2.	Determination of melt flow index of plastics.	05
3.	Determination of moisture contents	03
4.	Determination of carbon contents.	04
5.	Determination of filler content.	04
6.	Identification of plastics by simple methods	08
7.	Determination of water absorption.	06
8.	Determination of Hardness (Rockwell, Shore).	04
9.	Specimen preparation methods.	06
10.	Introduction to product testing-Pipe testing	08
	Total Nos. of Hours	54

Course Outcomes:

Upon completion of the course students will be able to:

- Test different parameters of plastic materials and products.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	3	3	3	3	1	1	2	2

SEMESTER - IV

Course Type	Course Code	Name of Course	L	T	P	Credit
Core	MMT 401	Engineering Materials & Heat Treatment	43	11	-	03
Course Objective						
<ul style="list-style-type: none"> To develop knowledge on the structure, properties, treatment, testing and applications of ferrous and non-ferrous metals so as to identify and select suitable materials for various engineering applications. 						
Learning Outcomes						
<ul style="list-style-type: none"> The students will be able to identify the different materials, understand the ferrous and non-ferrous metals and its applications, The students will be able to learn the heat treatment processes. 						
Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome			
1.	Concept of Structure	9	<ul style="list-style-type: none"> Understanding different structure, Unit cell and calculation of atoms/ Coordination number/ packing factor. 			
2.	Ferrous and Non-Ferrous Materials	10	<ul style="list-style-type: none"> Describe different types of cast iron and steel; application in engineering field. Identify cast iron, steel, and alloys steel as per their uses. Select non-ferrous metals and understand their uses. Study of non-ferrous alloys and its applications. 			
3.	Phase Transformation of Metals	15	<ul style="list-style-type: none"> Describe phase transformation stages in iron with respect to the temperature and effect of heat treatment on Properties of iron. Draw the iron-carbon equilibrium and TTT diagram and explain briefly the effect of temperature on microstructure of steel and iron. Explain different types of microstructures with neat sketch 			
4.	Heat Treatment Process & Material Testing	20	<ul style="list-style-type: none"> Explain the significance of heat treatment in the Manufacturing process. Explain the different types of heat treatment process. Study on advanced heat treatment techniques Describe Mechanical Properties and Testing of materials viz. Hardness test, Impact Test. Non-Destructive Testing (NDT) 			
Total No. of Hours		54				

Text Books:

- R.S. Khurmi, R.S Sedha, "Material science", S.Chand, Publisher, 2004.
- V.K. Manchanda, G.B.S Narang, "Materials and Metallurgy", Khanna Publisher, 1996.
- Serope Kalpak Jian, Steven R.Schmid, "Manufacturing Process for Engineering Materials, Pearson Education, 2018.

Reference Books:

- Sharma C.P, "Engineering Materials", PHI Learning, 2015.
- Kotgire V.D, "Material Science and Metallurgy", Everest Publishing House, 2015.

Course Outcomes:

Upon completion of the subject, the student will be able to:

- Know the various properties of ferrous and non-ferrous metals, effects of alloying elements.
- Understand Iron-Carbon Equilibrium Diagram and TTT Diagram.
- Understand the various processes of Heat Treatment and its effect on crystal structure.
- Learn material testing methods.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	3	3	3	1	1	2	3	3
CO2	3	3	3	2	3	2	2	3	3
CO3	3	3	3	3	3	2	2	3	3
CO4	3	3	3	3	3	1	2	3	3

Course Type	Course Code	Name of Course	L	T	P	Credit
Core	MMT 402	Plastics Product & Mould Design	43	11	-	03

Course Objective

- The objective of this course is to provide students with the knowledge of designing plastic products and moulds/dies. The course also covers the principles and guidelines of product design and mould/die design.

Learning Outcomes

- Understanding the concepts of Plastics Product Design.
- Understanding the various types of mould/die design aspects.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Introduction to Plastics Product design	9	<ul style="list-style-type: none"> • Knowledge of product design features and its application while designing for plastic parts.
2.	Design of Injection Moulds	25	<ul style="list-style-type: none"> • To study injection moulding machine specification. • General injection mould construction and its design features • Exposure on different mould parts and its functions • Study of 2-Plate, 3-Plate moulds, external undercut moulds, spilt moulds, cam track moulds • Study of internal undercut, form pin, collapsible core, loose cores, threaded inserts, internal and external threads
3.	Design of Blow Mould & Extrusion Dies	10	<ul style="list-style-type: none"> • Describe the blow mould and extrusion die design & its considerations
4.	Design of Compression & Transfer moulds	10	<ul style="list-style-type: none"> • Understanding compression and transfer mould design and its considerations.
Total No. of Hours		54	

Text Books:

- Paul F. Mastro "Plastics Product Design Engineering", Wiley-Scrivener Publisher, First Edition, 2016.
- Fundamentals of Plastic Mould Design, Sanjay K. Nayak, Pratap Chandra Padhi, Y. Hidayathullah Tata Mcgraw Hill Education Private Limited, 2012
- Injection Mould Design by R G W Pye, Edition, 2000

Reference Books:

- Douglas M. Bryce, "Plastic Injection Molding: Mold Design and Construction Fundamentals", Society of Manufacturing Engineers, 1998.
- Handbook of Thermoplastics Injection Mould Design by P.S. Cracknell and R.W. Dyson | 23 August 2014
- Injection-mould Design Fundamentals by A.B. Glanvill and E.N. Denton | 1 January 1965

Course Outcomes:

Upon completion of the subject, the student will be able to:

- Understand the Plastics Product design aspects.
- Familiarize with injection moulding machine specifications and mould design aspects.
- Familiarize with Blow & Extrusion mould/ die design aspects.
- Knowledge on compression mould and transfer mould design aspects.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	3	3	3	1	1	2	2	3
CO2	3	3	3	2	3	2	2	3	2
CO3	3	3	3	3	3	2	2	3	2
CO4	3	3	3	3	3	1	2	3	3

Course Type	Course Code	Name of Course	L	T	P	Credit
Core	MMT 403	Machine Shop Technology-II	43	11	-	03

Course Objective

This course aims to provide basic knowledge and hands on experience on:

- To understand the basics of metal removal techniques by using milling and grinding machines.
- To develop a knowledge of appropriate parameters to be used for machining operations viz. milling and grinding.

Learning Outcomes

- To develop skill on milling and grinding machines for manufacturing of mould/die parts.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Milling Machine	18	<ul style="list-style-type: none"> • Construction and working principle of milling machine & types, cutters and work holding / tool holding devices and their purposes. • Cutting parameters of milling machine • Study on different milling operation • Different milling methods and its applications • Knowledge on coolants and lubricants used. • Maintenance and Safety precaution while working on the machine
2.	Surface Grinding Machine	12	<ul style="list-style-type: none"> • Identifying surface grinding parts, Types of Grinding and working principle. • Selection of grinding wheels and standard marking/specification of grinding wheel. • Knowledge on balancing, glazing and loading of wheels • Speed and feed parameters • Study on attachments used • Maintenance and Safety precaution while working on the machine
3.	Cylindrical Grinding Machine	12	<ul style="list-style-type: none"> • Identifying cylindrical grinding parts, Types and working principle • Selection of grinding wheels and its shapes/sizes for different operations • Knowledge on balancing, glazing and loading of wheels • Speed and feed parameters • Study on attachments used • Maintenance and Safety precaution while working on the machine
4.	Tool & Cutter Grinder	12	<ul style="list-style-type: none"> • Identifying Pedestal and Tool and cutter grinding machine parts, Types and working principle

			<ul style="list-style-type: none"> • Selection of grinding wheels for different materials • Knowledge on single and multi-point cutter and drill bits • Study on accessories and attachments used • Maintenance and Safety precaution while working on the machine
	Total No. of Hours	54	

Text Books:

- S.K Hajra Choudhury, Nirjhar Roy “Elements of workshop Technology, Volume – II”, Media Promoters& Publisher Pvt. Ltd., 2018.
- R.S.Khurmi, J.K.Gupta “A Textbook of Workshop Technology”, S. Chand Publishing, 2008.

Reference Books:

- R.K. Jain, “Production Technology”, Khanna Publishers, 2001
- Rajendra K. Jain, “Mechanical & Industrial Measurements”, Khanna Publishers, 1988.

Course Outcomes:

Upon completion of the subject, the student will be able to:

- Understand mechanism of metal cutting techniques and understand how cutter angles effect the cutting processes
- Acquire skill on working of general-purpose machine tools and on various manufacturing processes.
- Acquire skill to produce different mould parts by using milling and Grinding machine
- Calculate cutting variables in Milling and Grinding machines.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	3	3	3	1	1	3	3	1
CO2	3	3	3	2	2	1	2	3	1
CO3	3	3	3	3	2	1	2	3	1
CO4	3	3	3	3	2	1	2	3	2

Course Type	Course Code	Name of Course	L	T	P	Credit
Core	MMT 404	Plastics Processing Techniques	43	11	-	03

Course Objective

This course aims to provide basic knowledge and hands on experience on:

- To facilitate the students to understand the various processing techniques of plastic materials. To learn the fundamentals and basic processing of thermoplastics by injection moulding, Blow moulding, Extrusion, Compression moulding, Transfer Moulding, Thermoforming methods and Rotational Moulding. To develop the knowledge on automation system and use of robotics in moulding process, Knowledge on advanced injection moulding Processes.

Learning Outcomes

- To learn the fundamentals and basic processing of different moulding processes, to develop the knowledge on automation system and use of robotics in moulding process. Knowledge on advanced injection moulding Processes.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Injection Moulding	14	<ul style="list-style-type: none"> • Introduction to Injection Moulding machine specifications, parts and their functions. • Process variables, Influence of processing parameters on the quality of the moulding, Setting of moulding conditions for a particular job • Causes & remedies of common moulding faults. • Operator safety aspects and routine quality control involved Safety procedures to be adopted to complete mould removal process • Introduction to advanced injection moulding like gas assisted, reaction injection and multi-colour
2.	Study of Blow Moulding Process	6	<ul style="list-style-type: none"> • Operation Principle – Process - Specification - Types - Processing parameters - Parison Programming - machine features - Cycle time –Clamping - Heating & cooling system - Mould venting – Fault Causes & Remedies
3.	Extrusion Techniques	14	<ul style="list-style-type: none"> • Extrusion: Principles - classification of extruders – types of screws – L/D ratio, compression ratio-back pressure, heating & cooling systems – breaker plate – screen pack & its functions – process variables and troubleshooting.

			<ul style="list-style-type: none"> • Operation & Principle of Pipe Extrusion - Profile Extrusion - Film Extrusion - Co-Extrusion -Crosshead Extrusion - Twin screw extruder - Vented Barrel Extruder. • Extrusion Accessories: Hopper loading devices – Drying equipments – Process, machinery – downstream equipments – dies for producing products
4.	Compression Moulding, Transfer Moulding, Thermoforming Techniques and Rotational Moulding	14	<ul style="list-style-type: none"> • Knowledge of Compression and Transfer Moulding Process – principles- effect of moulding pressure, mould temperature, defects and their causes- quality control • Knowledge of Thermoforming methods, Thermoforming moulds, Thermoforming equipment description • Rotational moulding working principle, process requirement for the moulding - water tank, Dust Bin, faults and remedies, operator safety
5.	Automation and Secondary Process	6	<ul style="list-style-type: none"> • Automation – use of robots in part handling, application of robotics in moulding process, material handling, conveying • Introduction to Secondary processes – electroplating, various printing techniques, and different welding techniques
	Total No. of Hours	54	

Text Books:

- Irvin, I.Rubin, “Injection Moulding: Theory and Practice” Wiley India Pvt. Ltd.Publisher, 2013.
- Michael, L.Berins, “Plastics Engineering Hand Book”, For the Society of the Plastic Industry,Publisher Springer; First Edition, 2012.

Reference Books:

- Donald V. Rosato, Dominick V. Rosato, “Plastics Processing Data Hand Book”, Springer Dordrecht, First Edition, 2012.
- A Brent Strong, “Plastics: Materials and Processing” Pearson, Third Edition, 2005.

Course Outcomes:

Upon completion of the subject, the student will be able to:

- Gain knowledge of processing of plastic materials by injection moulding,
- Understand extrusion and blow moulding Techniques.
- Understand techniques like compression moulding, transfer moulding, Thermoforming and rotational moulding Processes.
- The students will be able to handle automation system and robotics in moulding process

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	3	3	3	1	1	3	3	1
CO2	3	3	3	2	2	1	2	3	1
CO3	3	3	3	3	2	1	2	3	1
CO4	3	3	3	3	2	1	2	3	2

Course Type	Course Code	Name of Course	L	T	P	Credit
Elective -1	MMT405	Industrial Management	43	11	-	3

Course Objective
Industrial management deals to impart training on plant layouts, production planning and control, work, motion study etc. that has direct impact on key deliverables of industry.
Learning Outcomes
Awareness about management and its functions, human resources, develop awareness about quality and techniques to achieve quality through planning and adopting quality control measures, TQM. To have an idea about entrepreneurship and setting up of a Small-Scale Industry.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Basic Principles	4	Principles of Management
2.	Functions of Management	6	Planning, Organizing, Staffing, Directing, Controlling, Decision making.
3.	Organization	8	Awareness about Organizational Structure, Line & Staff Organization, Leadership, Motivation and Communication.
4.	Human Resource Management	8	Awareness about Human Resource Management, Job description, Manpower Planning, Job Evaluation, Performance Appraisal, Training
5.	Quality Control	8	Understanding of concept and features of Quality Planning and Quality Control, Total Quality Control.
6.	ISO	6	Awareness about Quality Assurance and ISO9001
7.	Total Quality Management	8	Understanding of concept of TQM and Organizational Excellence and Techniques of TQM.
8.	Entrepreneur	6	Understanding of the concept of Entrepreneur & Entrepreneurship
	Total Classes	54	

Text Books:

- Dr. Vijayendra Kumar Shrivastava, Dr. Pradeep Kumar Mishra, "Industrial Management & Entrepreneurship", Mahaveer Publications, 2020.
- V. Ravi, "Industrial Engineering and Management", PHI Learning Publisher, First Edition
- R.S Davar, "Personal Management & Industrial Relations", SChand Publisher, 10th Edition, 2018.

Reference Books:

- TelsangMartand, "Industrial Engineering and Production Management", S. Chand Publishing, 2017.

Course Outcomes:

Upon completion of the subject, the student will be able to:

- Able to understand the basic concepts of Management.
- Able to understand about Management System & Organization Able to know the
- basics of Quality Assurance & Quality Management
- Acquire the basics of Entrepreneurship

Mapping of course outcomes with program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	0	0	1	1	2	3	3	1	1
CO2	1	1	1	1	2	3	3	1	1
CO3	1	2	2	1	2	3	3	2	2
CO4	2	2	1	1	1	2	3	2	2

Course Type	Course Code	Name of Course	L	T	P	Credit
Elective	MMT 405	Design of Jigs, Fixture and Gauges	43	11	-	03

Course Objective

- To learn basic concepts, functions and design principles of Jigs, Fixtures and Dies
- To know the importance of work piece location & clamping

Learning Outcomes

- To learn the fundamentals of jigs, Fixture and gauges

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Basics of Jigs and Fixtures	12	<ul style="list-style-type: none"> • Introduction to Jigs and Fixtures • Difference between Jigs and Fixtures, Advantages of jigs and Fixtures • Economy and cost, Elements of Jigs and Fixtures, Fool Proofing • Materials used in Jigs and Fixtures • Degrees of Freedom, 12 degrees of freedom, 6-point location principle (or) 3-2-1 principle of location • Essential features of Jigs and Fixture • General Design Principles, Design steps, Common defects in Jigs design
2.	Principles of Location and Clamping	12	<ul style="list-style-type: none"> • Principles of location, location point, types of locators, pins and studs, V block, cup and cone location points, adjustable locating points, special adjustable stops, location from finished holes in the work, Diamond pin locator, Cam operated 'V' locator, Quick action 'V' locator, Six-point location of a three-legged object, Location of a cylinder on a V-block. • Principles of clamping, types of clamping, lever clamp, hinged clamp, two-way clamp, swinging clamp, wedge clamp, eccentric clamping arrangement, quick action clamp, Cam operated clamp, quarter turn screw, Toggle clamp, Pneumatic and hydraulic clamps, Washers, 'C' washer, spherical and flat washers

3.	Jig Bushings and Drill Jigs	10	<ul style="list-style-type: none"> • Jig Bushing: Materials for jig bushing, press fit bushing, fixed renewable bushing, slip renewable bushing, liner bushing, screw bushing, miscellaneous type of drill bushings, bushing specifications. • Drill Jigs: Open drill jig plate drill jig, plate drill jig, template drill jig, channel drill jig, turn over drill jig, angle plate drill jig, closed box drill jig, leaf drill jig, post jig, indexing drill jig, universal drill jig, design of template and leaf jig.
4.	Principle of Fixture Design	12	<ul style="list-style-type: none"> • Introduction, principles of fixture design, element of fixtures, design consideration of locators and clamps for fixtures, types of fixtures, design of turning fixtures, mandrels, type of mandrels, boring fixtures, milling fixtures, essentials of milling fixtures, method of locating milling fixtures with respect to cutter position, grinding fixtures, surface grinding and cylindrical grinding fixtures, broaching fixtures, internal and external broaching fixtures, welding fixtures
5.	Gauges	8	<ul style="list-style-type: none"> • Introduction, limits gauges, Taylor's principle of limiting gauging application of limit gauges, material for limit gauge, three basic type of limit gauges, plug gauge, snap gauge, ring gauge, thickness and length gauges, recess gauges, step gauges, position gauges and receiver gauges • IS specifications for gauges, design of plug and snap gauges.
Total No. of Hours		54	

Text Books:

- Cyril, V.C Goold, George H LeCain ,Joyjeet Ghose, "Tool Design", McGrawHill Publisher, 2017.
- M.H.A. Kempster, "Introduction to Jig and Tool Design", Hodder & Stoughton Ltd, First Edition, 1964.
- P.H Joshi "Jigs and Fixtures", McGraw Hill Publisher, Third Edition, 2013.

Reference Books:

- GR Nagpal, "Tool Engineering and Design", Khanna Publishers, 6th Edition, 2011.
- Edward Hoffman, "Jig and Fixture Design", Cengage Learning, 6th Edition, 2012.
- Hiram E. Grant, "Jigs and Fixtures", McGrawHill Education, 1st Edition, 1989.

Course Outcomes:

Upon completion of the subject, the student will be able to:

- Understand the basics of Jigs and fixtures
- Know the Location of clamping.
- Comprehend the mounting of Jigs and Fixtures on machine tool.
- Understand the different types of Fixtures and Gauges

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	3	3	3	1	1	3	3	1
CO2	3	3	3	2	2	1	2	3	1
CO3	3	3	3	3	2	1	2	3	1
CO4	3	3	3	3	2	1	2	3	2

Course Type	Course Code	Name of Course	L	T	P	Credit
Elective	MMT 405	Hydraulics & Pneumatics	43	11	-	03

Course Objective

- Students must have knowledge of concepts of properties of liquids and gases. Students must aware with Fluid, its related concepts & applications.

Learning Outcomes

- To learn the fundamentals of hydraulics & Pneumatics principle, working and application.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Fundamentals of Fluid Power	12	<ul style="list-style-type: none"> • Power transmission modes. • Basics of Hydraulic systems. • Basics of Pneumatic systems. • Laws governing fluid flow: Pascal's law, continuity equation, Bernoulli's theorem, Boyle's law, Charle's law, Gay-Lussac's law. • Flow through pipes. • Working fluids used in hydraulic and pneumatic systems-types, ISO/BIS standards and designations, properties.
2.	Hydraulic Elements	12	<ul style="list-style-type: none"> • Pumping theory, Hydraulic Pumps - types, construction, working principle, applications, selection criteria and comparison. • Hydraulic Actuators, Control valves, Accessories - their types, construction and working. • Hydraulic Control valves - types, construction, working, materials and specifications.
3.	Hydraulic Circuits	8	<ul style="list-style-type: none"> • ISO symbols used in hydraulic circuits. • Circuit diagram, components, working and application of hydraulic circuits likes Control of single/double acting cylinder; Pump unloading, Intensifier, Regenerative, Synchronizing cylinders, Automatic Cylinder Reciprocation, Sequencing, Meter-in and Meter-out circuits.
4.	Pneumatic Elements	11	<ul style="list-style-type: none"> • Pneumatic piping layout. • Air compressors, Air receivers, Air Filters, Regulators, Lubricators (FRL unit): their types, construction, working, specifications and selection criteria of following air preparation and conditioning elements. • Pneumatic Actuators – types, construction and applications. • Pneumatic Control valves - types, construction, working, materials and specifications.

5.	Pneumatic Circuits	11	<ul style="list-style-type: none"> • ISO symbols used in pneumatic circuits. • Basic Pneumatic Circuits – Control of single and double acting cylinder, Speed control, Automatic cylinder reciprocation circuit, Quick exhaust, two-step feed control, Time delay circuit, circuit diagram, components, working and application. • Pneumatic Logic circuit design - classic method & cascade method.
	Total No. of Hours	54	

Text Books:

- R.Srinivasan, "Hydraulic and Pneumatic Controls", Vijay Nicole Publication, Fifth Edition, 2019.
- S. R. Mujumdar, "Oil Hydraulic Systems: Principles and Maintenance", Tata McGraw-Hill Publication, First Edition, 2017.

Reference Books:

- S. R. Mujumdar, "Pneumatic Systems", Tata McGrawHill Publication, Third Edition, 2017.
- Madan Mohan Das, Mimi Das Saikia, Bhargab Mohan Das, "Hydraulics and Hydraulic Machines", PHI Learning, 2013.

Course Outcomes:

Upon completion of the subject, the student will be able to:

- Differentiate hydraulic and pneumatic fluid-based systems.
- Select and operate various hydraulic and pneumatic elements.
- Operate and maintain hydraulic and pneumatic circuits.
- Operate and maintain various devices based on hydraulic and/or pneumatics.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	3	3	3	1	1	3	3	1
CO2	3	3	3	2	2	1	2	3	1
CO3	3	3	3	3	2	1	2	3	1
CO4	3	3	3	3	2	1	2	3	2

Course Type	Course Code	Name of Course	L	T	P	Credit
Core	MMTL401	Machine Shop Practice – II	-	-	144	03

Course Objective

The objective of Machine Shop Practice is to enable the students

1. To understand Constructional features of basic machine tools
2. To know the various Metal cutting operations and Machine tool parameters.

Learning Outcomes

Upon completion of this course, students can able to

1. Acquire skills on working with general-purpose machine tools and about various manufacturing processes.
2. Create model by demonstrating various milling operations
3. Develop a model by demonstrating various grinding operations

Exercise No.	Topics / Practical Outcomes	Lecture Hours
1.	Knowledge of milling machines and their parts and accessories, Attachments and applications.	06
2.	Knowledge of milling cutting tools and tool holding devices	04
3.	Understand safety precautions	04
4.	Learn to do Plain surface milling, slot –plain and angular milling	06
5.	Learn to do different types of milling -Pocket, Indexing and rotary.	06
6.	Be able to operate Milling machines in a safe and competent manner.	20
7.	Knowledge of Surface grinders, work holding device, grinding wheels and their set up, maintenance and procedures for use.	06
8.	Types of surface grinders and accessories used for surface grinding operations and describe their applications.	06
9.	Considerations used to determine feed, speed and depth of Cut for grinding operations.	04
10.	Procedures used to set up grinders and align the work piece	06
11.	Demonstrate ability to do plain surface, slot, angular surface and form grinding	14
12.	Demonstrate knowledge of cylindrical grinders, work holding device, grinding wheels and their set up, maintenance and procedures for use.	06
13.	Knowledge of milling machines and their parts and accessories, Attachments and applications.	10
14.	Ability to operate cylindrical Grinding machines to produce precision parts by executing different types of grinding operations	10
15.	Be able to operate Cylindrical Grinding machine in a safe and competent manner.	06
16.	Demonstrate knowledge of Tool and cutter grinders, their set up procedures for use.	10
17.	Ability to operate Grinding of single point, Form Tool, Drill, Reamer and Milling Cutters.	20
	Total Nos. of Hours	144

Course Outcomes:

Upon completion of the course students will be able to:

- Developing sequence of machining operations required for industry.
- Manufacturing of components as per given drawings.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	3	3	3	3	1	1	3	2
CO2	3	3	3	3	3	1	1	3	2

Course Type	Course Code	Name of Course	L	T	P	Credit
Core	MMTL402	Plastics Processing Lab	-	-	54	01

Course Objective

1. To facilitate the students to understand various processing techniques of plastic materials.
2. To learn the fundamentals and basic processing of thermoplastics by injection moulding, compression moulding, blow moulding and extrusion process.
3. To develop the skill on basic maintenance of hydraulic and pneumatic systems.

Learning Outcomes

Upon completion of this course, students can able to:

1. Operate plastics processing machinery like Injection moulding, Compression moulding, Blow moulding, Extrusion, etc.
2. Understand the basic maintenance of Hydraulics and Pneumatics.

Exercise No.	Topics / Practical Outcomes	Lecture Hours
1.	Familiarization with basic concepts, job requirements & basic related process.	04
2.	To know safety precautions to be taken on the shop floor	04
3.	Knowledge of semi-automatic injection moulding machine parts and their functions	04
4.	Operate semi-automatic injection moulding machine both pneumatic and hydraulic types	04
5.	Demonstrate ability to determine cycle time and adjust process parameters	04
6.	Knowledge of automatic injection moulding machine parts and their functions – clamping system, locating ring, machine daylight, dimensions, ejector stroke, tie-bar distance etc.	04
7.	Understanding process parameters and study of machine controls	04
8.	Knowledge of semi-automatic and automatic blow moulding machine parts and their functions	04
9.	Operation of blow moulding machines, familiarization with control switches, cycle-time analysis.	04
10.	Knowledge of compression and transfer moulding machine parts and their functions	03
11.	Demonstration of compression and transfer moulding	03
12.	Knowledge of extruder machine parts and their functions	04
13.	Operate the extrusion machine & its trouble shooting	04
14.	Have basic knowledge of maintenance – hydraulic and pneumatic systems-viscosity, directional valves, hydraulic pump- types and functions, electrical system, electrical heating systems, timers and motors	04
Total Nos. of Hours		54

Course Outcomes:

Upon completion of the course students will be able to have hands on experience on different types of moulding machines.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	3	3	3	3	1	1	2	2

Course Type	Course Code	Name of Course	L	T	P	Credit
Core	MMTL403	CAD Lab - I	-	-	54	01

Course Objective

The objective of CAD Lab is to provide practical knowledge to the students, to use Computer Aided Design (CAD) software to create, modify and optimize the design and drawings.

Learning Outcomes

Upon completion of this course, students can able to create drawings, add dimensions & texts on drawings, produce orthographic views using CAD software.

Exercise No.	Topics / Practical Outcomes	Lecture Hours
1.	Basic knowledge of Computer Aided Drafting and its advantages over manual drafting, Hardware and Software requirements	02
2.	Understanding CAD basics –main menu, starting a new drawing, drawing editor, entering commands using mouse, pull down menu, getting help, data entry, entity selection, error correction.	12
3.	Develop ability to use CAD- Set limits of Drawing, grid, snap, co-ordinates, ortho mode, zooming, drawing lines, arcs, circles, erase, undo, oops – commands, save and end commands- Editing,	12
4.	Ability to add dimensions and text, Edit drawings using various modified commands.	06
5.	Ability to add dimensions and text on drawings, copy, mirror, array, fillet, chamfer, hatching the sectional views.	08
6.	Demonstrate ability to Develop simple orthographic views and dimension it with text.	08
7.	Demonstrate ability to Develop detailed orthographic views with all features.	06
Total Nos. of Hours		54

Course Outcomes:

Upon completion of the course students will be able to:

- Have hands on experience on CAD Software

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	3	3	3	3	1	1	2	2

Course Type	Course Code	Name of Course	No of Hours	Credits
-	MMTL 404	Student Club Activities	Beyond Lecture / Tutorial Hours	02
Report to be submitted before the end of Fourth Semester				

Students should take up any of the following CIPET clubs of their interest and actively organise / participate / execute the club activities from the commencement of 3rd Semester. At the end of fourth semester students shall submit the report including photographs, achievements, certificates etc. to the nominated Faculty In-charge of respective Student Club of CIPET Centre. Club Activities are to be performed as prescribed by CIPET.

Total marks for the activity is 100. Based on the performance, the committee comprising of “Faculty In-charge of respective Student Club, Nodal Officer (Student Clubs) & Training In-charge” of CIPET Centre shall allot marks against the total of 100.

Details of presently available CIPET Clubs:

- National Service Scheme
- Entrepreneurship Development Cell
- Enviro Club (Nurture Nature)
- Music Club
- Debating Society & Quiz Club
- Citizen Consumer Club (CCC)
- Club of Performing Arts
- Photography Club
- Health and Wellness Club
- Readers Club
- Sports Club
- Standards Club
- Engineer’s Club

Scheme of Evaluation:(Only External Marks: 100)

Initiation / Involvement / Execution	-	20 %
Participation in external events for the respective clubs	-	20 %
Leadership & Interpersonal Skills	-	20 %
Documentary Report on Club Activities including Photographs of Club Events organised, Social Media Publicity, News Articles published (if any), and appreciations/awards received (if any) etc.	-	20 %
Presentation on total performance of club activities	-	20 %

SEMESTER – V

Course Type	Course Code	Name of Course	L	T	P	Credits
Core	MMT 501	CNC Machining Techniques	43	11	-	3

Course Objective

The objective of this course is to provide students with the knowledge of CNC machining techniques, including programming, controls, setup and operation. Students will learn how to use CNC machines and to create and edit CNC programs using G-codes and M-codes, select and mount appropriate tools and fixtures, perform basic and advanced machining operations, and troubleshoot common CNC problems. Students will also understand about various CNC machines such as CNC Lathe, CNC Milling, CNC Die Sinker EDM and CNC Wire cut EDM.

Learning Outcomes

Upon completion of this course, students can able to understand the evolution, construction and working principle of CNC machine tools and can plan, create, edit and simulate CNC programs and can able to decide on tools and work holding devices and can able to understand the troubleshooting of basic problems.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	CNC Machining Fundamentals	8	<ul style="list-style-type: none">Understanding the history, advantages, types, structural configuration, components, open and closed loop control systems, coordinate systems and difference between NC, CNC & DNC.
2.	NC Program and Programming	10	<ul style="list-style-type: none">Program planning, program structure, syntax, G-codes, M-codes and functions, common CNC cycles and sub-programs, tool corrections, CAD/CAM software and post-processors, simulation and verification tools.
3.	CNC Lathe and CNC Milling	20	<ul style="list-style-type: none">Classification, working principle, construction, parts and their functions, operations, axis designation, simple programming, cutting tools and tool holders, work holding devices, work piece alignment and datum setting, troubleshooting of common problems.CNC machining centres, classification, parts and operations, multi-axis machining.
4.	CNC Die Sinker EDM and CNC Wire cut EDM	12	<ul style="list-style-type: none">Types, working principle, construction, parts and their functions, operations, axis designation, simple programming.Work and tool holding devices, tool and work piece alignment, spark gap calculations.Purpose, types, properties and applications of die electric fluids.Troubleshooting common problems.

5.	Industry 4.0 Concepts and Terminologies	4	<ul style="list-style-type: none"> Understanding the fundamentals of Industry 4.0 related terminologies and their application in CNC Machining - Digital Manufacturing, Cyber Physical System, Industrial Internet of Things, Digital Twin, Artificial Intelligence, Machine Learning, Big Data Analytics, Cloud Computing, Robots and Autonomous Systems, Augmented Reality, Virtual Reality, Mixed Reality, Haptics, Smart Factory.
	Total No. of Hours	54	

Text Books:

- Radhakrishnan P, "Computer Numerical Control Machines", New Central Book Agency, 2013.
- B. S. Pabla and M. Adithan, "CNC Machines", New Age International, 2005.
- James Madison, "CNC Machining Handbook", Industrial Press Inc., 1996.

Reference Books:

- Ken Evans, "Programming of CNC Machines", Fourth Edition, Industrial Press Inc, 2016.
- Peter Smid, "CNC Programming Handbook", Third Edition, Industrial Press Inc., 2007.
- Warren S. Seames, "Computer Numerical Control: Concepts & Programming", Fourth Edition, DelmarThomson Learning, 2002.
- P N Rao, "CAD/CAM: Principles and Applications", Third Edition, McGraw Hill Education, 2017.

Course Outcomes:

By the end of this course, students will be able to:

- Explain the principles and applications of CNC machining and troubleshoot basic problems in CNC machines.
- Plan basic and advanced CNC machining operations and program using G-codes and M-codes.
- Understand the application of CAD/CAM software to design and simulate parts for CNC machining.
- Understand the latest trends of Industry 4.0 related to CNC machining.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	3	-	1	1	2	2	2	3
CO2	3	3	2	3	1	3	2	3	1
CO3	2	2	3	3	2	1	3	3	2
CO4	2	-	2	3	3	1	3	1	2

Course Type	Course Code	Name of Course	L	T	P	Credits
Core	MMT 502	Mould Manufacturing Technology	43	11	-	3

Course Objective
The objective of this course is to provide students with the knowledge of mould manufacturing technology. The course covers the basic principles of mould/die materials selection, machining methods, assembly, proving, inspection, and maintenance of moulds/dies. The course also introduces the latest trends and developments in mould manufacturing technology, such as additive manufacturing, smart moulds, and micro-moulds.
Learning Outcomes
Upon completion of this course, students can able to select appropriate mould/die materials and manufacturing methods for different applications. They can also able to plan the process to manufacture quality mould/die components and assembling the mould/die, perform quality control, maintenance and troubleshooting of moulds/dies.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Mould Materials	8	<ul style="list-style-type: none"> • Properties, selection criteria and performance characteristics, ferrous, non-ferrous and non-metallic materials used for mould manufacturing, commonly used mould materials, material processing and treatment methods. • Materials for prototype moulds.
2.	Mould Manufacturing Methods	14	<ul style="list-style-type: none"> • Procedure for manufacturing of moulds, mould manufacturing checklist, process planning, use of shaper, lathe, milling, drilling, grinding and pantograph machines for machining of mould parts, advantages and disadvantages of using conventional machines for mould manufacturing. • Use of CNC Lathe and CNC Milling machines for mould manufacturing, advantages and disadvantages.
3.	Non-Traditional Machining for Mould Manufacturing	16	<ul style="list-style-type: none"> • Process, applications and advantages of Electrical Discharge Machining, Chemical Machining, Photochemical Machining, Electrochemical Machining, Laser Beam Machining and Ultrasonic Machining in mould manufacturing. • EDM Electrodes - materials, design and manufacturing. • Additive manufacturing techniques for mould manufacturing; prototype mould manufacturing. • Introduction to micro-moulds and smart moulds.
4.	Mould Polishing, Assembly and Inspection	10	<ul style="list-style-type: none"> • Basics of polishing technology, polishability of mould materials, methods of polishing, types of polishing tools, ultrasonic polishing. • Surface graining and texturing.

			<ul style="list-style-type: none"> • Check list for mould systematic assembly, Fitting and assembly of various mould elements - core insert, cavity insert, sprue bush, ejection system, blue matching and die spotting, venting, final inspection, fitting of locating ring and carrier bar, mould trial checklist and mould proving. • Checklist for mould inspection, Introduction to mould inspection.
5.	Mould Maintenance and Repair Methods	6	<ul style="list-style-type: none"> • Causes and prevention of mould defects and failures. • Common mould problems such as wear, corrosion, cracking, warping, etc. • Mould cleaning, lubrication and storing methods. • Mould repair and modification techniques. • Welding techniques and considerations for mould repairing. • Electro deposition in damaged mould surfaces, Protective Coating.
	Total No. of Hours	54	

Text Books:

- Günter Mennig and Klaus Stoeckert, "Mold-Making Handbook", Third Edition, Hanser Publications, 2013.
- Georg Menges, Walter Michaeli and Paul Mohren, "How to Make Injection Molds", Third Edition, Hanser Publications, 2001.
- S K Hajra Choudhury and Nirjhar Roy, "Elements of Workshop Technology Vol. II: Machine Tools", Fifteenth Edition Revised, Media Promoters and Publishers Pvt. Limited, 2016.

Reference Books:

- Dangel R., "Injection Molds for Beginners", Second Edition, Hanser Publications, 2020.
- Harry Pruner and Wolfgang Nesch, "Understanding Injection Molds", Second Edition, Hanser Publications, 2020.

Course Outcomes:

By the end of this course, students will be able to:

- Identify mould/die components and justify the selection of materials.
- Plan mould/die manufacturing using traditional and non-traditional machining techniques.
- Identify the finishing requirements of mould/die components and plan for the systematic assembly of mould.
- Plan mould/die maintenance and repair activities.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	-	1	-	2	2	3	3	1
CO2	3	2	2	3	2	3	3	3	2
CO3	3	1	3	3	1	2	2	3	2
CO4	3	2	1	2	2	3	3	2	3

Course Type	Course Code	Name of Course	L	T	P	Credits
Core	MMT 503	Process Planning & Cost Estimation	43	11	-	3

Course Objective
The course objective of Process Planning & Cost Estimation is to provide students with the knowledge and skills to plan and estimate the manufacturing processes and costs for various products.
Learning Outcomes
Upon completion of this course, students can able to understand the process planning, process selection and also can estimate the cost of process for manufacturing products by planning material requirement and by doing work study and time study.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Introduction to Process Planning	8	<ul style="list-style-type: none"> • Concept of Process Planning, Information and factors required to do process planning, process planning procedure, Make or Buy decision using Break Even Analysis - simple problems. • Manual Process Planning, Computer Aided Process Planning. • Value Engineering – Definition, cost control vs cost reduction, value analysis and selection of product.
2.	Process Selection	8	<ul style="list-style-type: none"> • Knowledge of process & requirements – technological, specific component, process flow. • Factors affecting process selection, machine capacity, analysis of machine capacity, process and equipment selection procedure, process sheet description.
3.	Material Requirement	14	<ul style="list-style-type: none"> • Determination of man, machine and material requirements, simple problems, selection of material, jigs, fixtures, elements, types, applications, principles of location and clamping, jig bushes. • Study of Factors influencing choice of machinery, simple problems, preparation of operation planning sheet for simple mould components.
4.	Work Study and Time Study	10	<ul style="list-style-type: none"> • Work study concept, techniques to reduce work content, method study procedure, recording techniques used in method study, micro-motion study, principles of motion economy, therbligs, SIMO chart - cycle graph - Chrono cycle graph - work measurement. • Basic Procedures for the conduct of time study, calculation of standard time, simple problems. • Ergonomics – definition, objectives, applications, working environment, work place layout, other areas.

5.	Cost Estimation	14	<ul style="list-style-type: none"> • Basic understanding of Cost estimation, components of cost, direct cost, indirect cost, overhead expenses, estimation of cost elements, set up time and economic lot size, tool change time, Inspection time, performance factor. • Elements of metal machining - cutting speed, feed, depth of cut, procedure for assigning cutting variables, basic formulae for calculation of material removal rate and machining times, use of standard tables for feeds and cutting speeds, exercises in calculating the machining times for various operations, simple problems based on Design for Manufacturing and Design for Assembly.
	Total No. of Hours	54	

Text Books:

- R. Kesavan, C. Elanchezhian, B. Vijaya Ramanath, "Process Planning and Cost Estimation", Second Edition, New Age International, 2019.
- Lakhwinder Pal Singh, "Work Study and Ergonomics", Cambridge University Press, 2018.

Reference Books:

- T.R Banga and S.C Sharma, "Mechanical Estimating and Costing", Seventeenth Edition, Khanna Publishers, 2001.
- Sinha B.P. "Mechanical Estimating and Costing", McGrawHill, 1995.
- Russell R.S. and Taylor, B.W, "Operations Management", 4th Edition, PHI, 2010.

Course Outcomes:

By the end of this course, students will be able to:

- Understand and apply the concepts and principles of process planning and cost estimation for different types of products and processes.
- Analyse the factors affecting the process planning and cost estimation such as design, materials, quality, productivity, and environment.
- Solve problems related to process planning and cost estimation.
- Develop the ability to communicate effectively and work in teams on process planning and cost estimation projects.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	2	2	1	1	3	3	3	1
CO2	3	3	2	1	3	2	3	3	3
CO3	3	3	3	3	2	2	2	2	3
CO4	2	1	1	1	-	3	1	1	3

Course Type	Course Code	Name of Course	L	T	P	Credit
Elective	MMT 504	Additive Manufacturing Processes	43	11	-	03

Course Objective

- To educate students with fundamental and advanced knowledge in the field of Additive manufacturing technology and the associated Aerospace, Architecture, Art, Medical and industrial applications.

Learning Outcomes

- To learn the fundamentals of the different Additive Manufacturing Process.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Introduction & Vat Photo Polymerization AM Processes	12	<ul style="list-style-type: none"> Introduction to AM, AM evolution, Distinction between AM & CNC machining, Steps in AM, Classification of AM processes, Advantages of AM and Types of materials for AM. Vat Photo polymerization AM Processes: Stereo lithography (SL), Materials, Process Modelling, SL resin curing process, SL scan patterns, Micro-stereo lithography, Mask Projection Processes, Two-Photon vat photo polymerization, Process Benefits and Drawbacks, Applications of Vat Photo polymerization, Material Jetting and Binder Jetting AM Processes.
2.	Extrusion - Based & Sheet Lamination AM Processes	12	<ul style="list-style-type: none"> Extrusion - Based AM Processes: Fused Deposition Modelling (FDM), Principles, Materials, Process Modelling, and Plotting and path control, Bio-Extrusion, Contour Crafting, Process Benefits and Drawbacks, Applications of Extrusion-Based Processes. Sheet Lamination AM Processes: Bonding Mechanisms, Materials, Laminated Object Manufacturing (LOM), Ultrasonic Consolidation (UC), Gluing, Thermal bonding, LOM and UC applications.

3.	Powder Bed Fusion AM Processes	8	<ul style="list-style-type: none"> • Selective Laser Sintering (SLS), Materials, Powder fusion mechanism and powder handling, Process Modelling, SLS metal and ceramic part creation, Electron Beam Melting (EBM), Process Benefits and Drawbacks, Applications of Powder Bed Fusion Processes.
4.	Directed Energy Deposition AM Processes	11	<ul style="list-style-type: none"> • Process Description, Material Delivery, Laser Engineered Net Shaping (LENS), Direct Metal Deposition (DMD), Electron Beam Based Metal Deposition, Processing-structure-properties, Relationships, Benefits and drawbacks, Applications of Directed Energy Deposition Processes. Materials science for AM - Multifunctional and graded materials in AM, Role of solidification rate, Evolution of non-equilibrium structure, microstructural studies, Structure property relationship.
5.	Post Processing of AM Parts	11	<ul style="list-style-type: none"> • Support Material Removal, Surface Texture Improvement, Accuracy Improvement, Aesthetic Improvement, Preparation for use as a Pattern, Property Enhancements using Non-thermal and Thermal Techniques. Guidelines for Process Selection: Introduction, Selection Methods for a Part, Challenges of Selection, Example System for Preliminary Selection, Process Planning and Control.
Total No. of Hours		54	

Text Books:

- Ian Gibson, David W Rosen and Brent Stucker, "Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing", Second Edition, Springer, 2015.
- Patri K. Venuvinod and Weiyin Ma, "Rapid Prototyping: Laser-based and Other Technologies", Springer, 2004.

Reference Books:

- Chee Kai Chua and Kah Fai Leong, "3D Printing and Additive Manufacturing: Principles and Applications", Fifth Edition, World Scientific, 2017.
- D.T. Pham, S.S. Dimov, "Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling", Springer, 2011.
- Rafiq I. Noorani, "Rapid Prototyping: Principles and Applications", Wiley, 2005.

Course Outcomes:

Upon completion of the subject, the student will be able to:

- Understand the working principle and process parameters of AM processes
- Explore the applications of AM processes in various fields
- Select the suitable material and process for fabricating a given product
- Apply the knowledge in Material science in Additive Manufacturing Components.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	3	3	3	1	1	3	3	1
CO2	3	3	3	2	2	1	2	3	1
CO3	3	3	3	3	2	1	2	3	1
CO4	3	3	3	3	2	1	2	3	2

Course Type	Course Code	Name of Course	L	T	P	Credit
Elective	MMT 504	Computer Aided Manufacturing	43	11	-	03
Course Objective						
<ul style="list-style-type: none"> The aim of the course is to impart the students the basic and essential concepts in using Computer Aided Manufacturing (CAM) and Computer Numerical Control (CNC) machines. Students will learn the basic concepts of manufacturing planning and control. They will be offered hands on experience in using CAM software to design, simulate and write CNC programs. 						
Learning Outcomes						
<ul style="list-style-type: none"> To learn the fundamental of role of CAM and automation technologies in manufacturing of different mould parts. 						
Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome			
1.	Computer Aided Manufacturing	12	<ul style="list-style-type: none"> CAM Concepts, Objectives & scope, Nature & Type of manufacturing system, Evolution, Benefits of CAM, Role of management in CAM, Concepts of Computer Integrated Manufacturing, Impact of CIM on personnel, Role of manufacturing engineers, CIM Wheel to understand basic functions. 			
2.	Programmable Logic Controllers	12	<ul style="list-style-type: none"> Relay Device components, Programmable controller architecture, programming a programmable controller, tools for PLC logic design, use of PLC in NC/CNC Machine Tools. 			
3.	Flexible Manufacturing System	10	<ul style="list-style-type: none"> Introduction & Component of FMS, Needs of FMS, general FMS consideration, Objectives, Types of flexibility and FMS, FMS lay out and advantages. Automated material handling system: Types and Application, Automated Storage and Retrieval System, Automated Guided Vehicles, Cellular manufacturing, Tool Management, Tool supply system, Tool Monitoring System, Flexible Assembly Systems. 			
4.	Robot Technology	12	<ul style="list-style-type: none"> Introduction: Robot Anatomy, Laws of Robot, Human System and Robotics, Coordinate system, Specifications of Robot. Power sources, actuators and Transducers, Robotic Sensors, Grippers, Robot Safety, Robot Programming and Robot Applications, Economic Considerations of Robotics system, Robot Kinematics and Dynamics, Robot Arm Dynamics. Concepts of Computer Vision and Machine Intelligence. 			

5.	Integrated Production Management System	8	<ul style="list-style-type: none"> Introduction, PPC fundamentals, Problems with PPC, Introduction to ERP. JIT & GT applied to FMS, concepts of Expert System in Manufacturing and Management Information System.
Total No. of Hours		54	

Text Books:

- Tien-Chien Chang, Richard A. Wysk and Hsu-Pin Wang, "Computer-Aided Manufacturing", Third Edition, Pearson Education, 2005.
- Mikell P. Groover, "Automation, Production Systems, and Computer-Integrated Manufacturing", Fifth Edition, Pearson Education, 2020.

Reference Books:

- S R Deb and S Deb, "Robotics Technology and Flexible Automation", Second Edition, McGraw Hill, 2010.
- William W. Luggen, "Flexible Manufacturing Cells and Systems", Prentice Hall, 1991.

Course Outcomes:

Upon completion of the subject, the student will be able to:

- Illustrate Computer Aided Manufacturing with NC, CNC and PLC technology for Industry
- Describe Flexible Manufacturing System with tools and equipment's.
- Describe Robot technology for Computer Aided Manufacturing system.
- Describe the Group Technology and Computer Aided Process Planning.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	3	3	3	1	1	3	3	1
CO2	3	3	3	2	2	1	2	3	1
CO3	3	3	3	3	2	1	2	3	1
CO4	3	3	3	3	2	1	2	3	2

Course Type	Course Code	Name of Course	L	T	P	Credit
Elective	MMT 504	Industrial Automation & Mechatronics	43	11	-	03

Course Objective

- To introduce the importance of automation techniques manufacturing and process industries
- To impart the role of PLC in industry automation

Learning Outcomes

- To Learn the fundamentals of automation process and its application in manufacturing industries

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Automation Mechatronics	12	<ul style="list-style-type: none"> • Definition, need, advantages and disadvantages of automation. • Definition of Mechatronics, benefits of mechatronics, Mechatronics in manufacturing, Mechatronics in products, Mechatronics & Engineering Design, A modular approach to mechatronics & Engineering Design, The engineer & mechatronics, mechatronics technology, Mechanical systems & design, Tradition Vs Mechatronics, mechatronics approach, Replacement mechanism, simplification mechanism, Enhancement mechanism, Synthesis of mechanism, control, The design process.
2.	Sensors and Transducers	12	<ul style="list-style-type: none"> • Sensors and Transducers, Performance terminology, Displacement, position and proximity, Velocity and motion, Force, Fluid pressure, Liquid flow, liquid level, temperature light sensors, selection of sensors.
3.	Actuators Electrical actuation systems	8	<ul style="list-style-type: none"> • Pneumatic and Hydraulic System • Actuation systems, pneumatic and hydraulic systems, Directional control valves, Pressure control valve, Cylinders, Process control valves, Rotary actuators. • Electrical systems, mechanical switches, solid state switches, solenoids principle of working, types, specification and control of DC motor and AC motors, Stepper motors.
4.	Programmable Logic Controller	11	<ul style="list-style-type: none"> • Basic structure, Input/Output processing, Programming, mnemonics, Timers, internal relays and Counters, shift register, Master and jump controls, Ladder logic circuit, Data handling, Analogue input/output, selection of PLC, Micro controllers and applications.

5.	Mechatronics systems and Fault finding	11	<ul style="list-style-type: none"> • Man-Machine interface, Traditional and Mechatronics design, Introduction, elements of product design, ergonomic factors for advanced manufacturing systems. • Information transfer, from machine to man, Human response to stimuli, Information from man to machine. • Fault detection techniques, common hardware faults. Possible design solutions, Timed switch, bathroom scales.
	Total No. of Hours	54	

Text Books:

- C R Venkataramana, "Fundamental of Mechatronics", Sapna Book House, 2018.
- D.A. Bradley, D. Dawson, D. Burd and A.J. Loader, "Mechatronics: Electronics in Products and Processes", Routledge, 2018.

Reference Books:

- HMT, "Mechatronics", McGraw Hill, 2017.
- W. Bolton, "Mechatronics: A Multidisciplinary Approach", Fourth Edition, Pearson Education, 2014.

Course Outcomes:

Upon completion of the subject, the student will be able to:

- Familiar with various automation technologies in manufacturing and process industries.
- Understand various automation tools and methods in manufacturing industry.
- Implement various control and automation method in process industries.
- Familiar with various communication technologies in manufacturing and process industries.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	3	3	3	1	1	3	3	1
CO2	3	3	3	2	2	1	2	3	1
CO3	3	3	3	3	2	1	2	3	1
CO4	3	3	3	3	2	1	2	3	2

Course Type	Course Code	Name of Course	L	T	P	Credits
Open Elective- 1	MMT 505	Artificial Intelligence & Machine Learning	43	11		3

Course Objective
To introduce students to the domain of Artificial Intelligence.
Learning Outcomes
Student will have general idea about Artificial Intelligence, will be able to explore AI tools effectively.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Introduction to Artificial Intelligence	08	Overview and Historical Perspective, Turing test, Physical Symbol Systems and the scope of Symbolic AI, Agents.
2.	Heuristic Search & Randomized Search	12	Heuristic Search: Best First Search, Hill Climbing, Beam Search, Tabu Search Randomized Search: Simulated Annealing, Genetic Algorithms, Ant Colony Optimization.
3.	Finding Optimal Paths Problem Decomposition Game Playing	16	Branch and Bound, A*, IDA*, Divide and Conquer approaches, Beam Stack Search. Goal Trees, AO*, Rule Based Systems, Rete Net. Minimax Algorithm, AlphaBeta Algorithm, SSS.
4.	Planning and Constraint Satisfaction	10	Domains, Forward and Backward Search, Goal Stack Planning, Plan Space Planning, Graphplan, Constraint Propagation
5.	Logic and Inferences	08	Propositional Logic, First Order Logic, Soundness and Completeness, Forward and Backward chaining
	Total No. of Hours	54	

Text Books:

- Deepak Khemani, "A First Course in Artificial Intelligence", McGraw Hill, 2013.
- Stefan Edelkamp and Stefan Schrod, "Heuristic Search: Theory and Applications", Morgan Kaufmann, 2011.
- Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill, 1991.

Reference Books:

- Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill, 1991
- Stuart Russell and Peter Norvig "Artificial Intelligence: A Modern Approach", Third Edition, Prentice Hall, 2009.
- <https://nptel.ac.in/courses/106106126/>

Course Outcomes:

- Students will gain knowledge on Symbols of Artificial Intelligence.
- Students will gain knowledge different types of Searches towards Artificial Intelligence.
- Students will gain knowledge on planning towards Artificial Intelligence Activities.
- Students will be able to gain knowledge on Logics and Interferences on Artificial Intelligence.

Course Mapping with Program Outcomes.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	1	1	1	3	0	1	1	3	1
CO2	2	1	1	3	2	1	2	2	1
CO3	1	1	0	3	3	1	2	2	1
CO4	2	2	1	3	3	1	3	3	1

Course Type	Course Code	Name of Course	L	T	P	Credits
Open Elective- 2	MMT 506	Project Management	43	11		3

Course Objective

- To develop the idea of project plan, from defining and confirming the project goals and objectives, identifying tasks and how goals will be achieved.
- To develop an understanding of key project management skills and strategies.

Learning Outcomes

Student will acquire knowledge on Concepts of Preparation of Project including Budget Preparation, estimates and Projection.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Concept of a Project	06	<ul style="list-style-type: none"> • Classification of projects • Importance of project management • The project life cycle • Establishing project priorities(scope-cost-time) • Project priority matrix • Work breakdown structure
2.	Capital budgeting process	10	<ul style="list-style-type: none"> • Planning-Analysis-Selection-Financing-Implementation-Review. • Generation and screening of project ideas • Market and demand analysis • Demand forecasting techniques. • Market planning and marketing research process • Technical Analysis
3.	Financial Estimates and Projections	12	<ul style="list-style-type: none"> • Cost of projects • Means of financing • Estimates of sales and production-cost of production • Working capital requirement and its financing • Profitability projected, cash flow statement and balance sheet • Breakeven analysis.
4.	Basic Techniques in Capital Budgeting	12	<ul style="list-style-type: none"> • Non discounting and discounting methods • Payback period • Accounting rate of return • Net present value • Benefit cost ratio • internal rate of return. • Project risk • Social cost benefit analysis and economic rate of return • Non-financial justification of projects

5.	Project Administration	14	<ul style="list-style-type: none"> • Progress payments • Expenditure planning • Project scheduling and network planning • Use of Critical Path Method (CPM) • Schedule of payments and physical progress • Time-cost trade off • Concepts and uses of PERT • Cost as a function of time • Project Evaluation and Review Techniques • Cost mechanisms • Determination of least cost duration. • Post project evaluation. • Introduction to various Project management software.
Total No. of Hours		54	

Text Books:

- K Nagarajan, "Project Management", Seventh Edition, New Age International Publishers, 2015.
- Prasanna Chandra, "Projects: Planning, Analysis, Selection, Financing, Implementation and Review", Ninth Edition, McGrawHill, 2019.
- Erik W. Larson and Clifford F. Gray, "Project Management: The Managerial Process", Eighth Edition, McGraw Hill, 2021.

Reference Books:

- P Gopalakrishnan and V E Ramamoorthy, "Textbook of Project Management", Laxmi Publications, 2022.
- Harvey Maylor and Neil Turner, "Project Management", Fifth Edition, Pearson, 2021.

Course Outcomes:

- Understand the importance of projects and its phases & Analyze projects from marketing, operational and financial perspectives
- Evaluate projects based on discount and non-discount methods.
- Develop network diagrams for planning and execution of a given project.
- Apply crashing procedures for time and cost optimization.

Course Mapping with Program Outcomes.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	1	1	1	2	0	3	1	2	1
CO2	2	1	3	2	2	1	2	2	1
CO3	1	2	1	3	3	1	2	2	1
CO4	1	2	2	3	3	1	3	3	1

Course Type	Course Code	Name of Course	L	T	P	Credits
Open Elective- 2	MMT 507	Internet of Things	43	11		3

Course Objective

The course objective for Internet of Things is to provide students with a comprehensive understanding of the principles, technologies, and applications of IoT systems.

Learning Outcomes

This course will prepare the students for the emerging opportunities and challenges in the IoT domain, and equip them with the skills and knowledge to develop and use IoT products and services.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Introduction to Internet of Things	18	<ul style="list-style-type: none"> Define the term "Internet of Things" State the technological trends which have led to IoT. Describe the impact of IoT on society
2.	Design consideration of IoT	18	<ul style="list-style-type: none"> Enumerate and describe the components of an embedded system. Describe the interactions of embedded systems with the physical world. Name the core hardware components most commonly used in IoT devices.
3.	Interfacing by IoT devices	18	<ul style="list-style-type: none"> Describe the interaction between software and hardware in an IoT device. Explain the use of networking and basic networking hardware. Describe the structure of the Internet.
	Total No. of Hours	54	

Text Books:

- Raj Kamal, "Internet of Things – Architecture and Design Principles", Second Edition, McGraw Hill Education, 2022.
- Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2015.
- Ammar Rayes and Samer Salam, "Internet of Things From Hype to Reality: The Road to Digitization", Second Edition, Springer, 2019.

Reference Books:

- Adrian McEwen and Hakim Cassimally, "Designing the Internet of Things", Wiley, 2014.
- Cuno Pfister, "Getting Started with the Internet of Things", O'Reilly, 2011.
- Hwaiyu Geng, "Internet of Things and Data Analytics Handbook", Wiley, 2017.

Course Outcomes:

- Understand the fundamental concepts, terminologies, and architecture of IoT systems.
- Understanding the Design and implementation process of IoT solutions for real-world problems.
- Understanding the various communication protocols and interaction between software and hardware essential for IoT system functionality.

Course Mapping with Program Outcomes.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	0	0	0	0	1	0	0	0
CO2	0	3	3	1	3	1	1	0	2
CO3	2	0	1	3	0	2	0	0	0

Course Type	Course Code	Name of Course	L	T	P	Credits
Core	MMTL 501	Mould Manufacturing Practice	-	-	144	3

Course Objective
The objective of Mould Manufacturing Practice is to enable the students to develop injection, compression, transfer, blow and thermoforming moulds/dies using traditional and non-traditional machining techniques.
Learning Outcomes
Upon completion of this course, students can able to plan and apply various machining techniques to develop injection, compression, transfer, blow and thermoforming moulds/dies and also can able to perform moulds/dies proving trials and troubleshoot the problems.

Unit No.	Topics to be Covered	Practical Hours	Learning Outcome
1.	Development of Automatic Injection Mould	3	Study of mould design and mould part drawings, preparation of mould manufacturing checklist, material plan, process plan and mould cost estimation.
		9	Rough machining of mould plates using shaping machine.
		12	Surface grinding of mould plates and mould elements.
		9	Drilling, reaming and tapping of mould plates and mould element.
		9	Precision machining of guide pillar & guide bush holes in mould plates using Jig boring machine / CNC milling machine.
		9	Rough machining of core and cavity of moulds using lathe/milling machine
		6	Machining cooling channels, feed system & vents
		6	Machining of cylindrical components of mould.
		6	Cylindrical grinding operation to maintain functional dimensions of hardened guide pillar, guide bush and other elements of mould.
		15	Precision machining of core and cavity of moulds using CNC machine tools.
		12	Machining of intricate shapes of Core and Cavity (soft/hardened) using CNC Die sinking EDM & CNC Wire cut EDM.
		6	Engraving and embossing of script & monograms using Pantograph / CNC machining techniques and other methods.
		3	Polishing of core, cavity, sprue bush, runner, gate etc. to mirror finish.
		3	Inspection of machined components of mould.
6	Assembly of Mould and mould proving.		

2.	Development of Blow Mould	18	Study of Mould design and mould part drawings; preparation of mould manufacturing checklist, material plan, process plan and mould cost estimation; machining of mould parts; Inspection of machined components of mould; Assembly of Mould and mould proving.
3.	Study of Development Process of Extrusion Die	3	Study of die design and die part drawings, preparation of die manufacturing checklist, material plan, process plan and die cost estimation.
4.	Study of Development Process of Compression Mould	3	Study of mould design and mould part drawings, preparation of mould manufacturing checklist, material plan, process plan and mould cost estimation.
5.	Study of Development Process of Thermoforming Mould	3	Study of mould design and mould part drawings, preparation of mould manufacturing checklist, material plan, process plan and mould cost estimation.
6.	Study of Development Process of Transfer Mould	3	Study of mould design and mould part drawings, preparation of mould manufacturing checklist, material plan, process plan and mould cost estimation.
	Total No. of Hours	144	

Course Outcomes:

By the end of this course, students will be able to:

- Understand the principles and techniques of moulds/dies manufacturing.
- Plan all activities related to moulds/dies manufacturing and perform various machining operations to manufacture moulds/dies.
- Inspect mould/die components, assemble the moulds/dies, take proving trials and troubleshoot.
- Demonstrate professionalism, teamwork, communication and problem-solving skills in mould / die manufacturing assignments.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	1	1	2	1	1	3	2	1
CO2	3	2	3	3	2	3	3	3	1
CO3	2	3	2	3	0	1	1	2	3
CO4	1	1	2	1	0	3	1	1	2

Course Type	Course Code	Name of Course	L	T	P	Credits
Core	MMTL 502	CAM & CNC Lab	-	-	54	1

Course Objective
The objective of CAM & CNC Lab is to provide students with the practical knowledge of CAM and CNC technologies to understand, plan, simulate the machining processes and also to machine and inspect the produced components of moulds/dies.
Learning Outcomes
Upon completion of this course, students can able to use the CAM software to Write and edit CNC programs using G-code and M-code for different types of CNC machines, generate tool paths, simulate machining processes, plan and perform various CNC machining operations in CNC machine tools such as lathes, mills and EDMs, and evaluate the quality and accuracy of CNC machined mould/die parts using measuring instruments and inspection methods.

Unit No.	Topics to be Covered	Practical Hours	Learning Outcome
1.	Familiarization with CAM	8	Understanding the use of CAM software to create 2D & 3D models, generate tool paths and simulate machining processes. (Recommended to use Autodesk Fusion 360 in the Lab and students can be guided to get free version for self-paced learning.)
2.	Familiarization with CNC Machine Tools	8	Understanding CNC machine tools, parts, functions, standard operating procedures of CNC Lathe, CNC Milling, CNC Die sinking EDM, CNC Wire cut EDM, etc. and cutting tools and cutting fluids used for them.
3.	Machining Mould Components using CNC Lathe Machine	8	Understanding the detailed drawings, planning the operation sequences & tools requirements, writing & editing CNC programs using G-codes and M-codes, simulating the machining process, job setting, machining the mould components in CNC Lathe machine and evaluating the quality & accuracy of CNC machined parts using measuring instruments and inspection methods.
4.	Machining Mould Components and Electrodes using CNC Milling Machine	14	Understanding the detailed drawings, planning the operation sequences & tools requirements, writing & editing CNC programs using G-codes and M-codes, simulating the machining process, job setting, machining the mould components and electrodes in CNC Milling machine and evaluating the quality & accuracy of CNC machined parts using measuring instruments and inspection methods.

5.	Machining Mould Components using CNC Die Sinking EDM	8	Understanding the detailed drawings, planning the operation sequences & electrode requirements, writing & editing CNC programs using G-codes and M-codes, simulating the machining process, job setting, machining the mould components in CNC Die Sinking EDM machine and evaluating the quality & accuracy of CNC machined parts using measuring instruments and inspection methods.
6.	Machining Mould Components using CNC Wire Cut EDM	8	Understanding the detailed drawings, planning the operation sequences & electrode requirements, writing & editing CNC programs using G-codes and M-codes, simulating the machining process, job setting, machining the mould components in CNC Wire cut EDM machine and evaluating the quality & accuracy of CNC machined parts using measuring instruments and inspection methods.
	Total No. of Hours	54	

Note: Simulation of machining operations may be done using open license software or any one of available free virtual labs (vlabs.iitkgp.ac.in, etc.).

Course Outcomes:

By the end of this course, students will be able to:

- Understand and use the CAM software to prepare CNC part programs.
- Plan the operations and tools, setup the jobs, generate the toolpaths, simulate the machining processes and execute the part program to machine mould/die components as per the production drawing.
- Inspect and evaluate the quality and accuracy of CNC machined parts using measuring instruments and inspection methods.
- Demonstrate the skills and competencies required for working in a CAM and CNC environment.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	3	2	3	3	0	2	2	3	2
CO2	3	3	3	3	2	3	3	3	3
CO3	3	2	0	3	0	1	1	3	1
CO4	2	0	0	0	1	3	2	2	3

Course Type	Course Code	Name of Course	L	T	P	Credits
Core	MMTL 503	CAD Lab - II	-	-	54	1

Course Objective

The objective of Mould Design Lab is to provide students with the practical knowledge of mould design for plastic injection moulding. The course introduces the design of common types of moulds, such as two-plate, three-plate moulds and also teaches the students how to use computer-aided design (CAD) software to create, modify and optimize mould models and drawings.

Learning Outcomes

Upon completion of this course, students can able to use CAD software to create and modify 3D models and 2D drawings of moulds and also can validate and optimize the mould designs using standard techniques and simulation tools.

Unit No.	Topics to be Covered	Practical Hours	Learning Outcome
1.	Familiarization with Parametric Modeling	6	Understanding the GUI of parametric solid modeling software and parametric modeling techniques to create mould parts. (Recommended to use Autodesk Fusion 360 in the Lab and students can be guided to get free version for self-paced learning)
2.	Design and Detailing of Two Impression Two-Plate Injection Mould	18	Mould parts design, core and cavity extraction, use of standard mould parts and standard mould base in mould design, mould parts assembly, production drawing preparation.
3.	Design and Detailing of Four Impression Three-Plate Injection Mould	21	Mould parts design, core and cavity extraction, use of standard mould parts and standard mould base in mould design, mould parts assembly, production drawing preparation.
4.	Familiarization with Mould Design Validation & Optimization and Mould Flow Analysis	9	Understanding the concepts of mould design validation, modification of mould design for optimization and the significance of mould flow analysis in mould design.
	Total No. of Hours	54	

Course Outcomes:

By the end of this course, students will be able to:

- Understand and use the CAD software to create and modify 3D models and production drawings of moulds.
- Apply the design rules and guidelines for creating a mould layout and selecting appropriate mould features.
- Analyse and evaluate the performance and feasibility of a mould design using simulation tools.
- Communicate and present their mould design ideas and solutions effectively using technical drawings and reports.

Course Mapping with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 01	PSO 02
CO1	2	2	3	1	0	1	1	3	1
CO2	3	3	3	1	2	3	2	3	1
CO3	2	3	2	3	0	2	1	1	3
CO4	2	1	1	0	1	3	2	2	2

Course Type	Course Code	Name of Course	No of Hours	Credits
-	MMTL 504	Industry Visits	Beyond Lecture / Tutorial Hours	02
Report to be submitted before the end of Fifth Semester				

Students should complete minimum 4 Nos. of Industrial Visits as per the details below:

- Product / Mould Design Industry
 - Mould Manufacturing Industry
 - CNC Industry
 - Tooling Industry
 - Robotics / Automation / CIM Industry
 - Hydraulics & Pneumatics Systems Manufacturing / Maintenance Industry
 - Machine Manufacturing / Maintenance Industry
 - Inspection / Testing Industry
 - Plastics Processing / Packaging Industry
 - Ferrous Materials Manufacturing Industry
 - Steel / Cast Iron Manufacturing Industry
 - Plastics Raw Materials / Master batches Manufacturing Industry
 - Any other relevant industry.
- Students shall visit minimum 4 industrial units among above mentioned, after completion of their 4th semester. All 4 visits shall be completed by the last academic working day of 5th semester. Students shall prepare the documentary Industry Visit Report including:
 - Photographs preferably with Geotag.
 - Technical Infrastructure viz. Machinery / Equipment available in the industry with specifications, operational procedure, Raw Materials used, Products manufactured, Safety Practices adopted, Implementation of any Technological Advancements and other Technical Information observed during the visit.
 - Students shall visit preferably different types of industries and the documentary report shall be submitted by the last working day of the 5th semester. Placement In-charge may coordinate with the industries & students for the visit.
 - Committee Comprising of “Training In-charge, Course In-charge, Placement Coordinator and any one Senior Technical Employee” shall be formed to assess the reports and to conduct viva voce for assessing the output of Industrial Visits and accordingly assign the marks as per prescribed scheme.

Scheme of Evaluation: (Only External Marks: 100)

Number of Industries Covered	-	40 %
Evaluation of Documentary Report submitted by students including Photographs / Proof of Visits, Technical Details Incorporated in report viz. Machinery / Equipment available in the industry with specifications, operational procedure, Raw Materials used, Products manufactured, Safety practices adopted, Implementation of any technological advancements and other Technical Information observed	-	40 %
Viva Voce	-	20 %

SEMESTER – VI

Course Type	Course Code	Name of Course	L	T	P	Credits
Core	MMTP601	Project Work & In-plant Training in Industry	-	-	540	7
Course Objective						
<p>The course outcome of this project is to enhance the students' technical competence, creativity, problem-solving ability, management and professional ethics in the field of plastics mould technology and also to improve their leadership, entrepreneurship and communication skills.</p>						
Learning Outcomes						
<p>Understanding the industry requirements, Identifying a problem or a need related to mould development, Conducting a literature review and market survey to find existing solutions and gaps, Proposing a feasible and innovative solution that meets the specifications and requirements, Preparing a detailed project plan with objectives, scope, methodology, timeline, budget and expected outcomes, Designing the mould using CAD software and performing simulations and analysis to optimize the performance and quality, Fabricating the mould using CNC machines and other tools and equipment, Proving the mould for functionality, reliability and durability, Documenting the work and presenting the results and findings.</p>						
Unit No.	Topics to be Covered	Total Hours	Learning Outcome			
1.	<p>Project Work</p> <p>Undertake a project. Project work may be identified in collaboration with industry.</p> <p>Projects shall preferably be done in an industry and shall be related to estimation and economics of production/ repair and maintenance of plant and equipment/ improving productivity/ quality assurance related to product or mould development or machining / manufacturing or any other related problems of interest for host industry with the approval of Project Guide.</p> <p>In-plant Training in Industry</p>	540	<p>Identifying a problem or a need related to mould development, Conducting a literature review and market survey to find existing solutions and gaps, Proposing a feasible and innovative solution that meets the specifications and requirements, Preparing a detailed project plan with objectives, scope, methodology, timeline, budget and expected outcomes, Designing the mould using CAD software and performing simulations and analysis to optimize the performance and quality, Fabricating the mould using CNC machines and other tools and equipment, Proving the mould for functionality, reliability and durability, Documenting the work and presenting the results and findings.</p> <p>Industrial Training will help the students to understand the broader industry requirements, have hands on experience and to carryout project work relevant to industry requirements. This will allow students to develop a problem-solving approach to face the challenges in the future.</p>			
Total Hours		540				

Course Outcomes:

- The student will be able to communicate efficiently and become a multi-skilled engineer with good technical knowledge, management, leadership and entrepreneurship skills that will help to identify, formulate and model problems and find engineering solution based on a systems approach.

Course Mapping with Program Outcomes.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
	3	3	3	3	3	3	3	3	3	3

Scheme of Evaluation:**Internal Evaluation: 300 Marks**

Monthly Attendance of In-plant Training	-	25 %
Monthly Progress Reports of In-plant Training	-	25 %
1 st Review of Project Work – 6 th Week of Semester	-	25 %
2 nd Review of Project Work – 12 th Week of Semester	-	25 %
Note: 1 st & 2 nd Review of Project Work shall be conducted by the officials of concerned CIPET centre with the Committee comprising of Project Guide, Course In-charge, Training In-charge & Head of the Department related to the Project Work.		

External Evaluation: 400 Marks

Project Report	-	25 %
Project Presentation	-	50 %
Project Work Viva voce	-	25 %

Course Type	Course Code	Name of Course	L	T	P	Credits
-	MMTP 602	Online Certification Course of CIPET / NPTEL	30	-	-	3

Course Objective

To undergo the specialised Online Courses of CIPET or NPTEL under MOOCs on Subject Related Technologies.

Learning Outcomes

Students in addition to acquiring the expertise of hands-on Industrial Training and project work, can gain the knowledge on recent technological advancements through online courses.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Online Certification Courses	30	Can acquire the Technical Knowledge in Areas of interest along with the Project Work / Industrial Training
	Min. Duration in Hours	30	

Scheme of Evaluation:

External Evaluation: 100 Marks

- As per the actual percentage of marks scored by the student in the final certification test of CIPET / NPTEL.

Course Type	Course Code	Name of Course	L	T	P	Credits
Audit Course	MMTP 603	Indian Constitution	2 Hours per Week	-	-	-

Unit No.	Topics to be Covered	No. of Hours	Learning Outcome
1.	The Constitution – Introduction	10	The History of the Making of the Indian Constitution Preamble and the Basic Structure, and its interpretation Fundamental Rights and Duties and their interpretation State Policy Principles
2.	Union Government	8	Structure of the Indian Union President – Role and Power Prime Minister and Council of Ministers Lok Sabha and Rajya Sabha
3.	State Government	6	Governor – Role and Power Chief Minister and Council of Ministers State Secretariat
4.	Local Administration	6	District Administration Municipal Corporation Zila Panchayat
5.	Election Commission	6	Role and Functioning Chief Election Commissioner State Election Commission
	Total No. of Hours	36	

Text Books:

- Rajeev Bhargava, "Politics and Ethics of the Indian Constitution", Oxford University Press, 2009.
- B.L Fadia and Dr. Kuldeep Fadia, "The Constitution of India", Sahitya Bhawan, 2020.
- D D Basu, "Introduction to the Constitution of India", Twenty Sixth Edition, LexisNexis, 2022.